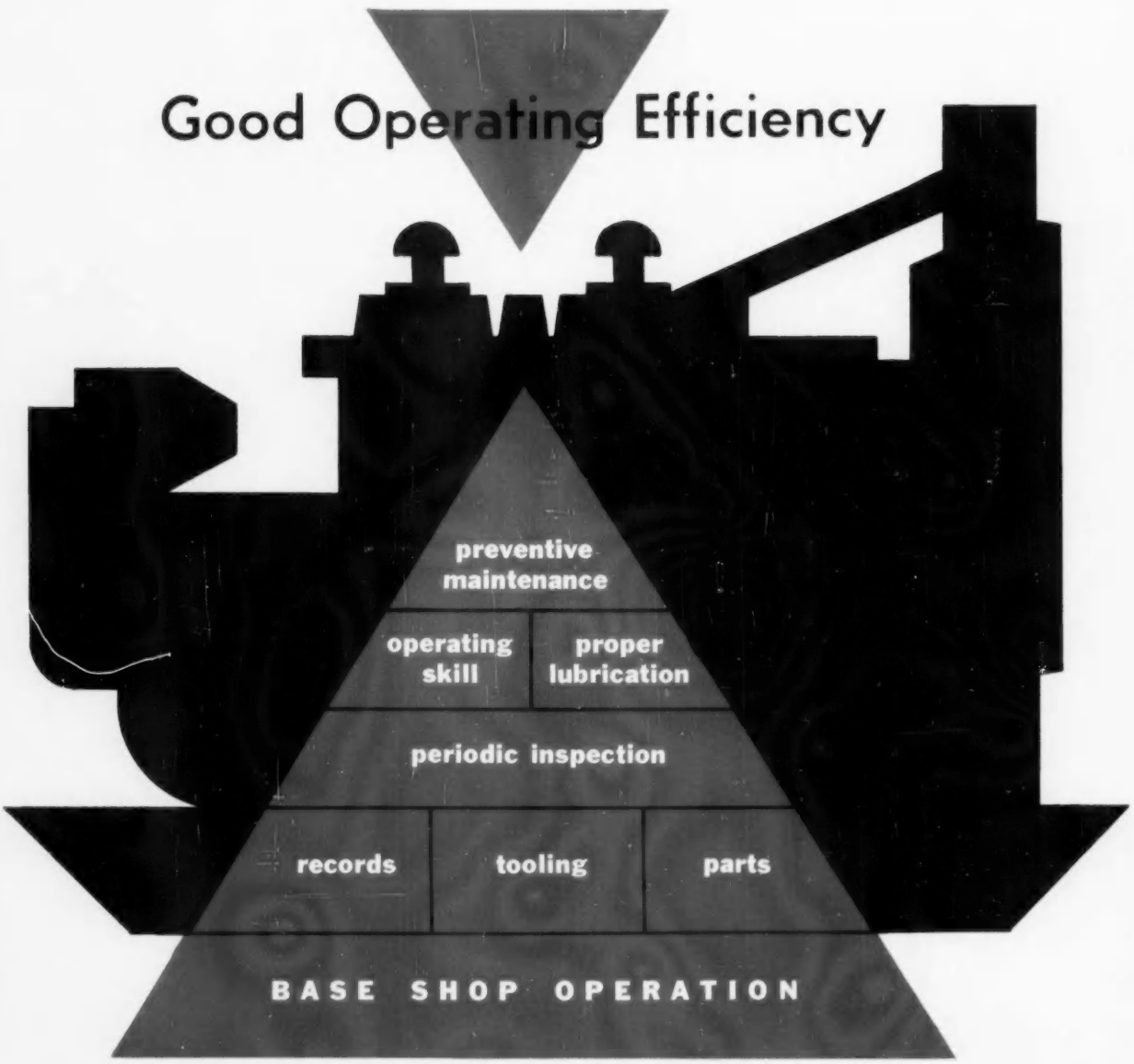
diesel power

October 1956



Here's the key to engine efficiency

Free-working piston rings mean more powerful, more dependable engine performance. Lubricate with one of the famous *Texaco Ursa Oils* and rings will stay free for full-power compression and complete combustion, even under the most severe conditions.

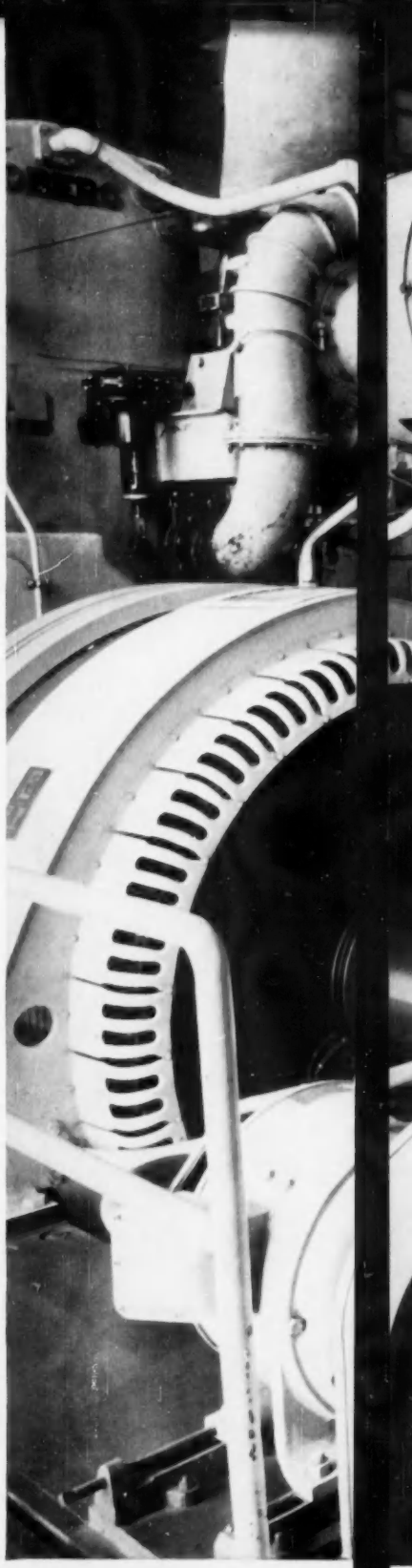
Moreover, *Texaco Ursa Oils* resist oxidation and sludging, prevent harmful deposits, reduce wear. You'll get dependable performance from a cleaner engine, save considerably on fuel and maintenance costs.

There is a complete line of *Texaco Ursa Oils*, especially refined and processed to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls. These outstanding benefits explain why —

For over 20 years, more stationary diesel horsepower in the U.S. has been lubricated with Texaco than with any other brand.

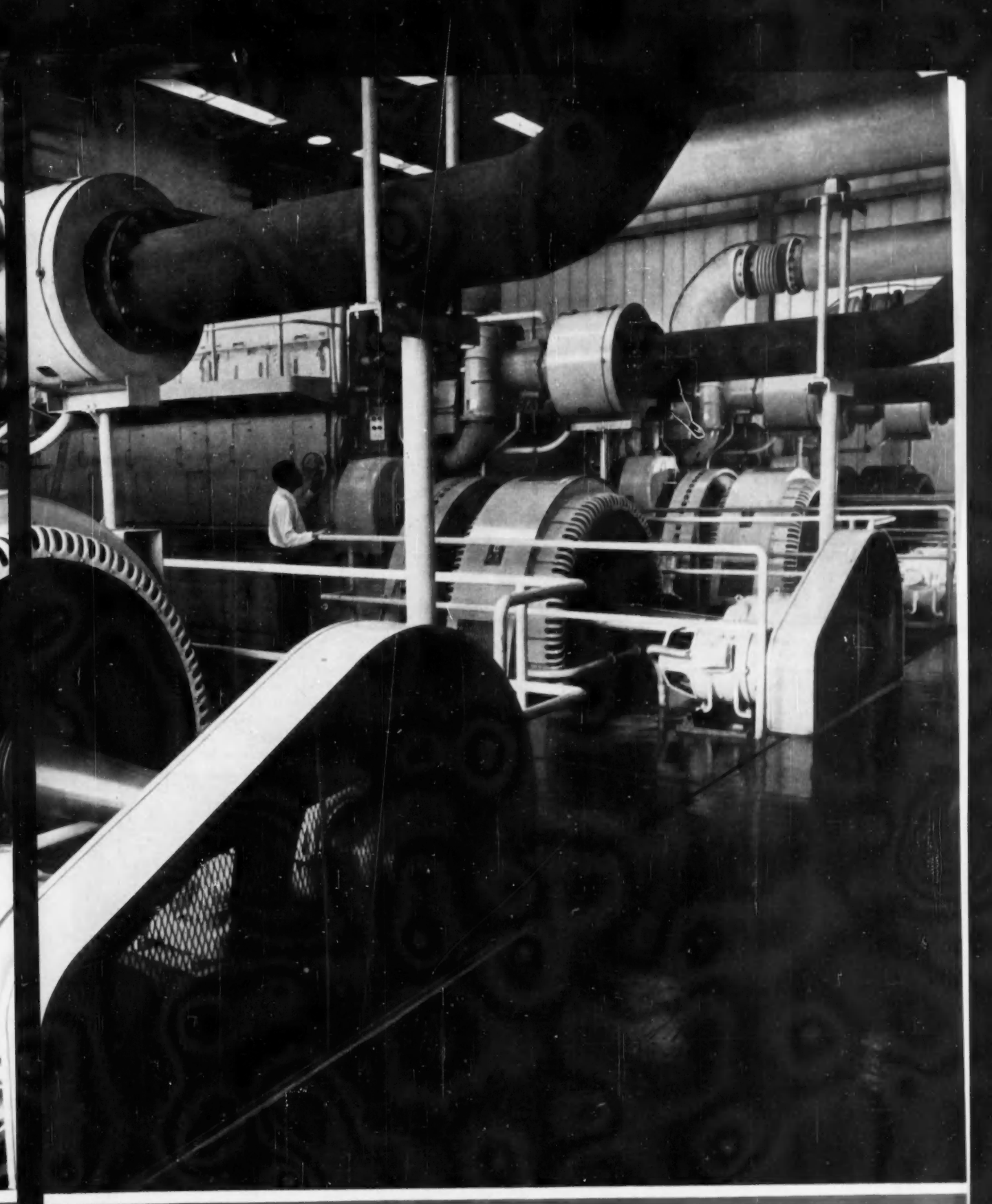
Get full information from a Texaco Lubrication Engineer. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO

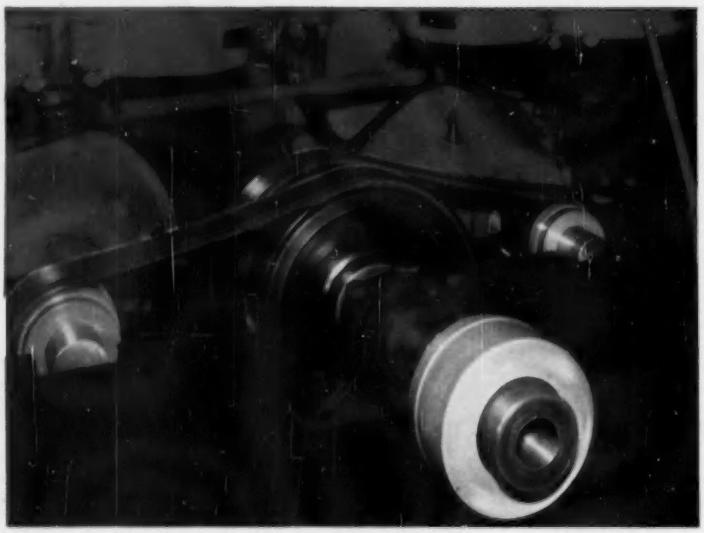
TEXACO



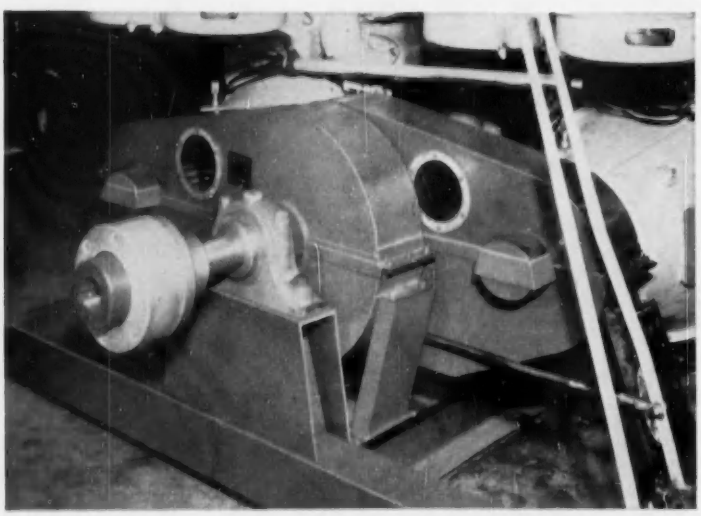
URSA OILS

FOR ALL DIESEL, GAS
AND DUAL-FUEL ENGINES

Get Maximum HP Output from High-Speed Diesel Engines with Morse Hy-Vo Drives



Note the smooth action of Morse HY-VO in operation. Matched 182-HP diesel engines, operating at 1450 RPM, are twinned through HY-VO Drives to jack shaft, which operates at 650 RPM. Jack shaft delivers 364 HP to load shaft (not shown), to which it is coupled with Morse Morflex Radial Coupling (see below).



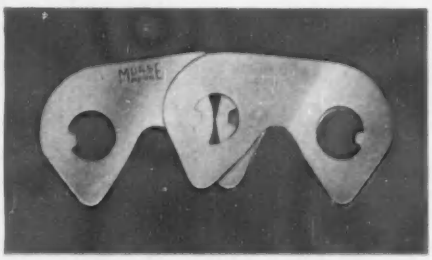
Twin HY-VO Drives are encased in sealed casings, permit continuous forced-spray and sump oil lubrication. Observation ports permit inspection. Morflex Radial Coupling cushions any shock loads from driven unit, prevents engine pulsations from entering driven shaft.

Southern Bearings Service and Lewis-Diesel Engine Company solved difficult cotton gin drive problem at low cost to customer.

Morse Hy-Vo Drives helped solve a typical power-transmission problem for Lewis-Diesel Engine Company (Memphis, Tennessee). Working with Southern Bearings Service, Inc., the local Morse distributor, they combined twin high-speed diesels with two Morse Hy-Vo drives to get low-cost, low-speed, high-horsepower output to a cotton gin main drive.

By compounding two small, high-speed diesel engines with required reduction ratios, the need for a big, expensive, low-speed engine was eliminated. Quick access to individual drive units was made possible without disturbing main compound base. Customer downtime is reduced to a minimum.

Compact Morse Hy-Vo Drives provide smooth, positive power transmission at speeds up to 8,500 fpm. They combine the positive action of gears with the favorable load distribution of chain; are rated at 20,000 hours' service life.



HY-VO Drive links, showing exclusive rocker-type joint. Rocker joint reduces wear and friction, results in coolest running chain drive.

Complete information free

For complete information and engineering assistance on Morse HY-VO Drives, contact your nearest Morse distributor. You'll find him listed in your local Yellow Pages. Call him today.

MORSE CHAIN COMPANY
INDUSTRIAL SALES DIVISION
ITHACA, N.Y.

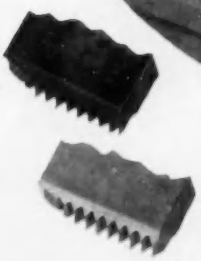
MORSE MORSE B-W *Trademark **POWER TRANSMISSION PRODUCTS**

V-B Liquid Honing*

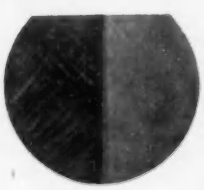
Your Way to Say:

"MOST MODERN PRODUCTION BLASTING EVER DEVELOPED!"

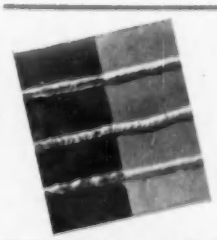
This Machine Should be Processing Your Parts



Vapor Blast Liquid Honing removes heat treat scale faster than conventional tumbling or any other process, and without pitting the steel.



Vapor Blast Liquid Honing blends out grind lines, as shown in the area to the left. The smooth, non-directional surface is ideal for oil flow and unequalled lubrication. Liquid-abrasive action also hones down tiny burrs along the edges of parts like this one.



This unretouched photo of three weld seams shows how efficiently you can remove mill scale, rust, welding and heat discolorations. Top weld is stainless steel; next, copper brazing; bottom, common steel.

For surface conditioning or finishing, a switch to Liquid Honing will save you a superintendent's pay in a year or less. Metals, plastics, ceramics — any material you use — can be Liquid Honed fast and to close tolerance. You get a better production job every time . . . at lower cost and without usual danger to the operator.

Send a sample scale-covered part with a letter describing your problem. Liquid Honing engineers will remove the scale and return the part with their recommendations. No cost to you . . . no obligation.

DOLLAR FOR DOLLAR, JOB FOR JOB, NO OTHER SURFACE-CONDITIONING METHOD CAN EQUAL LIQUID HONING

VAPOR V-B BLAST
MILWAUKEE, WISCONSIN

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new LONG LIFE PISTON

Puts CAST IRON WEAR IN TOP RING GROOVE

G and E Wire Insert Piston before machining (left) and after ring grooves are cut (right) showing how the steel wire forms a tough wear-resistant surface on both faces of top ring groove. The ferrous plug molded in the head (for diesel pistons) prevents burning through head and lengthens diesel piston life!

G and E WIRE INSERT PISTONS

Patent Pending

★ **Low initial cost— Low cost per mile**

★ **Amazing increase in piston life**

★ **Maintains new engine power and performance**

Here's an entirely new piston design that combines all the advantages of aluminum alloy pistons with the long life of steel in the top ring groove. No noticeable increase in weight. G and E Wire Insert Pistons are real top performers at LOW COST—barely more than ordinary alloy pistons!

This Gillett & Eaton exclusive steel wire insert cuts top ring groove wear and greatly increases mileage between overhauls.

You get longer piston wear at lower cost because G & E Wire Insert Pistons have a pre-shaped steel wire cast right in the piston wall where the top ring is located. When the grooves are machined, this tough wire is cut, exposing the closely spaced hard surfaced bearing points on top and bottom faces of the groove.

GET THE G AND E WIRE INSERT STORY—Ask your White Machine Works "Arrowhead" representative or write to Gillett & Eaton, Inc.

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diesel power

Established in 1923 **Vol. 34, No. 10** **October, 1956**

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Diesel Publications, Inc., 80 Lincoln Avenue, Stamford, Conn.

Walter T. Messeck, Supt. of Utilities at Tipp City, Ohio, sets Enterprise "Select-O-Matic" control for Dual Fuel operation.

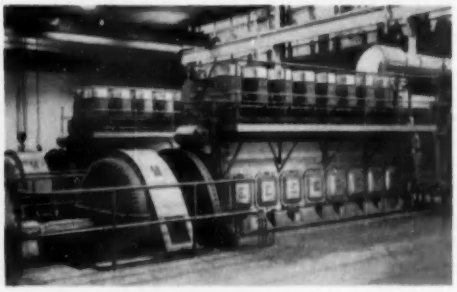
Dual Fuel? Heavy Fuel? Tipp City, Ohio, Profits From Both With Their Two Modern Enterprise Engines

As long as fuel prices fluctuate, and availability of different fuels varies, Enterprise "Select-O-Matic"® Dual Fuel engine systems contribute important savings in power production.

This is the case at Tipp City, Ohio, where they converted their Enterprise Engines from straight diesel operation just two years ago. Dual fuel operation on natural gas and No. 2 diesel pilot fuel is alternated on a seasonal basis, with straight diesel operation using either light or heavy fuel oils, depending on the current market price of the various grades of oil, during the winter months when gas is not available. Gas and heavy fuel operation is economical, and in this business the saving of as little as 1 mill per kilowatt hour amounts to a pretty penny when you're generating 9,488,200 KW hours a year as was the case at Tipp City in 1955.

Let us show you how Enterprise Dual Fuel economy can improve *your* operations. Write today for full information, or call your nearest Enterprise sales and service office.

The Tipp City Diesel Power Plant is a modern show place. Hundreds of visitors have inspected this efficient, well-run operation where two 1755 HP Enterprise Turbo-charged Engines supply all the power. Dual fuel and heavy fuel systems were installed in 1954, to take full advantage of the less expensive fuels available.



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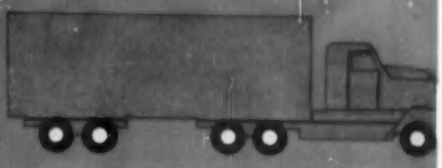
the finest diesels on land or sea use FRAM Filters



Here are the diesel leaders who specify Fram Filters as standard equipment

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Autocar Division of White Motor Company
Bacharach Industrial Instrument Co.
Buda Div. Allis-Chalmers Mfg. Co.
J. I. Case Company
Clark Equipment Co.
Continental Motors Corp.
Cummins Engine Co.
Diamond T Motor Car Co.
Euclid Division of General Motors Corp.
Gray Marine Motor Co.
Harnischfeger Corp.
Hedges Diesel, Inc.
Hercules Motors Corp.
Frank G. Hough Company
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Kohler Company
LeTourneau-Westinghouse Co.
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Diesel manufacturers and engineers specify FRAM protection for longer engine life . . . less wear . . . fewer repairs.

Give your diesel the same protection the experts choose—get FRAM!

FRAM CORPORATION
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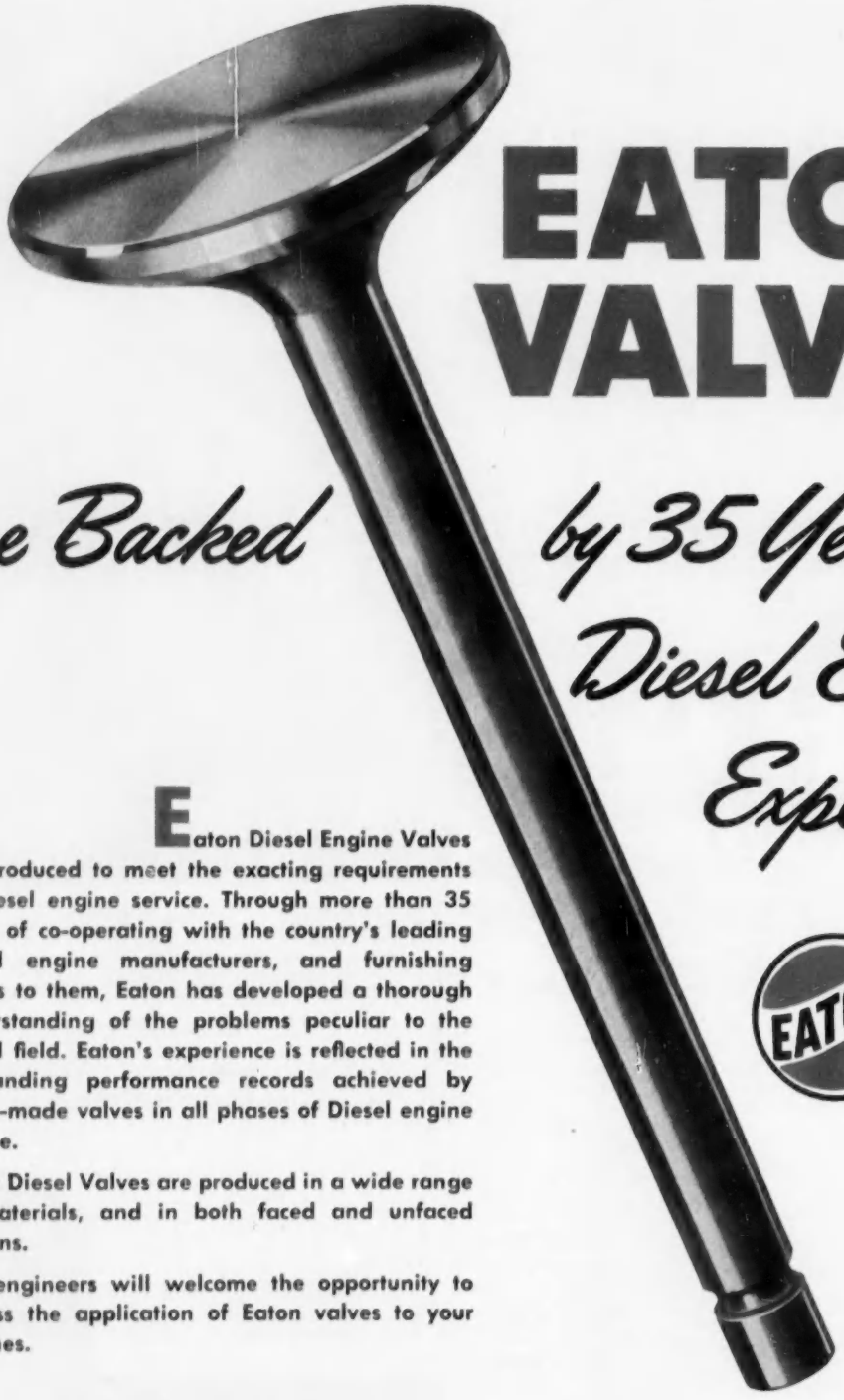
FRAM
OIL • AIR • FUEL • WATER
FILTERS



EATON VALVES

are Backed by 35 Years of Diesel Engine Experience

Eaton Diesel Engine Valves are produced to meet the exacting requirements of Diesel engine service. Through more than 35 years of co-operating with the country's leading Diesel engine manufacturers, and furnishing valves to them, Eaton has developed a thorough understanding of the problems peculiar to the Diesel field. Eaton's experience is reflected in the outstanding performance records achieved by Eaton-made valves in all phases of Diesel engine service.

Eaton Diesel Valves are produced in a wide range of materials, and in both faced and unfaced designs.

Our engineers will welcome the opportunity to discuss the application of Eaton valves to your engines.

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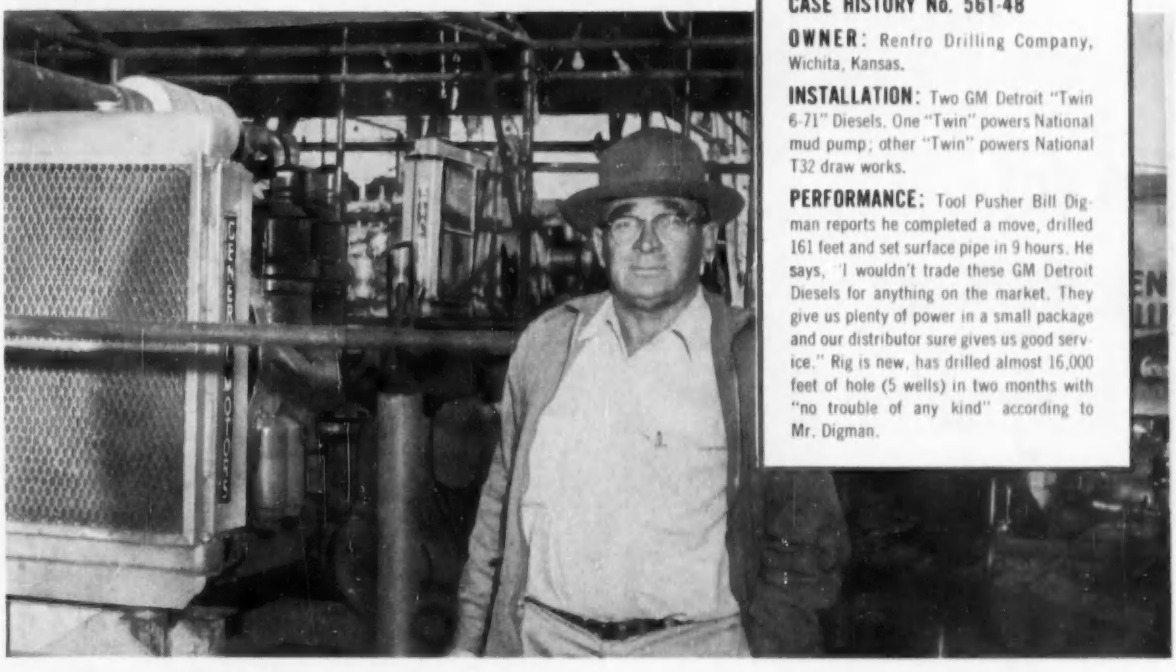
Makes Move—Drills 161 Feet—Sets Surface

ALL IN 9 HOURS



GM DETROIT DIESEL
CASE HISTORY No. 561-48

OWNER: Renfro Drilling Company, Wichita, Kansas.

INSTALLATION: Two GM Detroit "Twin 6-71" Diesels. One "Twin" powers National mud pump; other "Twin" powers National T32 draw works.

PERFORMANCE: Tool Pusher Bill Digman reports he completed a move, drilled 161 feet and set surface pipe in 9 hours. He says, "I wouldn't trade these GM Detroit Diesels for anything on the market. They give us plenty of power in a small package and our distributor sure gives us good service." Rig is new, has drilled almost 16,000 feet of hole (5 wells) in two months with "no trouble of any kind" according to Mr. Digman.

JIMMY DIESEL'S MAINTENANCE TIPS

Your GM Detroit Diesel is built to stay on the job day in and day out for a lifetime of hard work. You'll get even better service from your engine if you have your GM Detroit Diesel distributor or dealer set up a preventive maintenance program for you. Call him today, and remember—Preventive Maintenance Doesn't Cost, It Pays.

YOU SPEND more time drilling—less time moving—with a General Motors Detroit Diesel on your rig because this 2-cycle Diesel packs more power in a smaller, lighter engine that lets you make faster, easier moves usually without special road permits.

And with a GM Detroit Diesel you make hole faster, too. For its snappy 2-cycle operation with power on every piston downstroke gives you action *right now* when the driller hits the throttle. That means faster round trips, more time on bottom, quicker hole completion wherever you're drilling.

Your local GM Detroit Diesel distributor or dealer can give you full details on GM Detroit Diesel power for your drilling rigs—or for servicing or fracturing units. See him today or write direct for more information.

Single Engines . . . 50 to 500 H.P. *Multiple Units . . . Up to 895 H.P.*

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America's Largest Builder of Diesel Engines

SEE YOUR LOCAL TELEPHONE DIRECTORY

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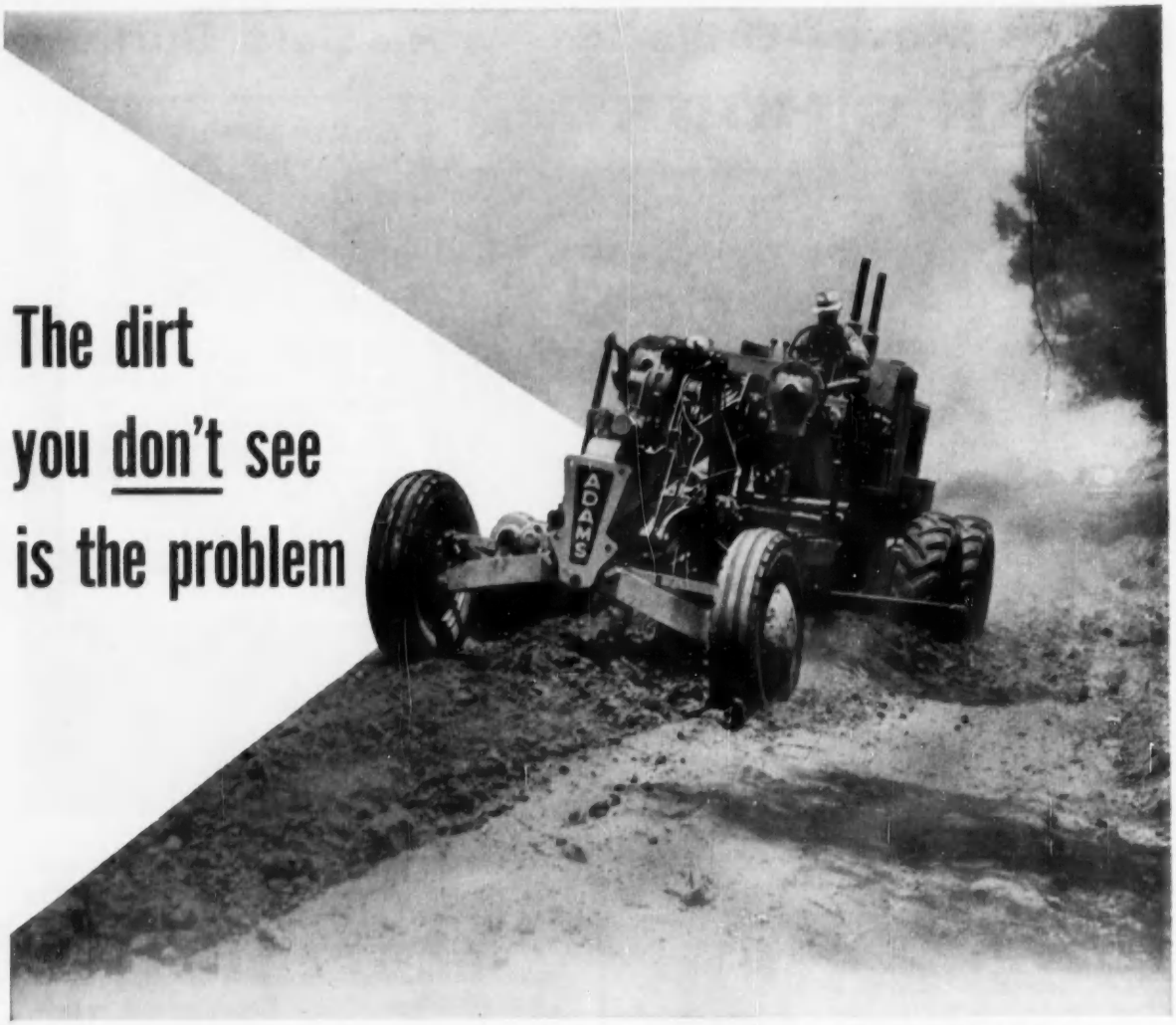
The dirt you don't see is the problem



Le-Tourneau-Westinghouse Adams "660" Grader, powered by 150 H. P. Diesel Engine

Dry Type Micronic® Air Filtration solves it

The tons of dirt this grader moves in a day don't give it any trouble at all. But just let a little of the dirt that's drawn in with the air intake get through to the engine and it'll stop dead in its tracks. That's why efficient air filtration is so vital to the operation of this equipment . . . why engine and equipment manufacturers have accepted PurOlator's new Dry Type Micronic® Air Filter as the most efficient yet developed.

Whether your engine is idling or revving at top speed, this new Purolator Air Filter removes 99% of all contaminants. That makes it virtually impossible for harmful abrasives to get into the precision parts of the engine no matter how dirty the job or where you're working. The Dry Type Micronic elements save time and effort in servicing, too. Elements can be replaced in one-tenth the time — and with one-tenth the effort — needed to service other types.

Purolator Catalog AFC-56 contains a valuable chapter "Facts about engine air requirements" that can help you prolong engine life and reduce repair bills. Send for your free copy today. Address Dept. D9-1011.

FILTRATION FOR EVERY KNOWN FLUID

PUROLATOR

PRODUCTS, INC.
RAHWAY, NEW JERSEY

TURBINE AND DIESEL LUBRICANT GUIDE

CITIES SERVICE TURBINE OILS

Manufactured from the highest quality, solvent refined stocks, these oils have high viscosity index, excellent heat resistance. They are chemically fortified to prevent oxidation, rust, and foaming, permit smoother operation.

PACEMAKER 150-T

Recommended for pressure-circulation systems of direct-connected steam turbines, and for the bearings of turbo-generators where pressure-circulation of the oil is employed.

PACEMAKER 300-T

For use in the lubrication of steam turbines with single reduction gear units. Also for the lubrication of high-speed, ring-oiled, auxiliary turbines, where operating temperatures are not above 200°F.

PACEMAKER 400-T

Recommended for the lubrication of propulsion turbine units on naval and commercial vessels, in pressure-circulation systems.

PACEMAKER 500-T

Suitable for the lubrication of ring-oiled bearings of auxiliary turbines where operating conditions require an oil of heavier body than Pacemaker 300-T. Also recommended for use in separately lubricated turbine gear reduction units.

PACEMAKER 750-T

Recommended for the lubrication of high-speed, ring-oiled, auxiliary turbines, where operating temperatures are in excess of 200°F., and use of a heavier bodied oil is required.

CITIES SERVICE DIESEL OILS

Made in the world's most modern lubricating oil refinery at Lake Charles, Louisiana, Cities Service Diesel Oils are blended from highest quality, high V.I. mineral oils and fortified with specially developed additives. There's a Cities Service Diesel Oil tailored for top performance in every type of diesel operation.

D-C 300 SERIES

These oils are designed to fully conform to Military Specification MIL-L-2104A. Made from the finest base oils, they are strongly fortified against oxidation and corrosion. They have the necessary detergent-dispersant properties to insure superior lubrication performance in high speed Diesel engines operating under heavy duty service.

Recommended for service DG under A.P.I. classification system.

D-C 100 SERIES

These oils are designed to conform to U. S. Army Specification 2-104B (Supplemental List 1). They are also known as Superior Lubricants Series 1 and are intended for more severe service than the D-C 300 Series Oils. Particularly recommended for the lubrication of medium and high-speed Diesel engines using lower quality fuels.

Recommended for service DM under A.P.I. classification system.

D-C 500 SERIES

These oils meet the requirements of The Caterpillar Tractor Company for a "Superior Lubricant (Series 3)". They have the highest level of detergent-dispersant action with maximum oxidation and corrosion protection to assure reliable operation of Diesel engines under most severe service conditions or where low quality fuels of very high sulphur content are used.

Recommended for service DS under A.P.I. classification system.

PACEMAKER SERIES

The new Pacemaker line of Diesel engine oils is made from the same high quality base oils as are the Pacemaker T Series, and contains similar additives, but in lesser amounts. These oils are adaptable for use in many low and medium speed stationary engines operating under conditions which would not require the use of heavier fortified oils, such as the Pacemaker T Oils.

PACEMAKER T SERIES

These are medium duty, high grade, high V.I. oils fortified against oxidation, rust and foam. Admirably suited for slow and medium speed engines employing the dry sump system of lubrication and operating under conditions where the service is not severe enough to benefit from a full heavy duty oil.

NEPTUNE 9000 SERIES

Designed specifically for lubrication of marine-type Diesel engines, both military and commercial.

Neptune 9000 Series Oils are made from high quality, high V.I. solvent refined stocks and are strongly fortified against oxidation and corrosion. They are specially inhibited against silver alloy bearing corrosion and have the necessary detergent-dispersant properties to give maximum performance under severe operating conditions.

These oils conform to the requirements of Military Specification MIL-L-900 C (SHIPS) for marine Diesel engine lubrication.

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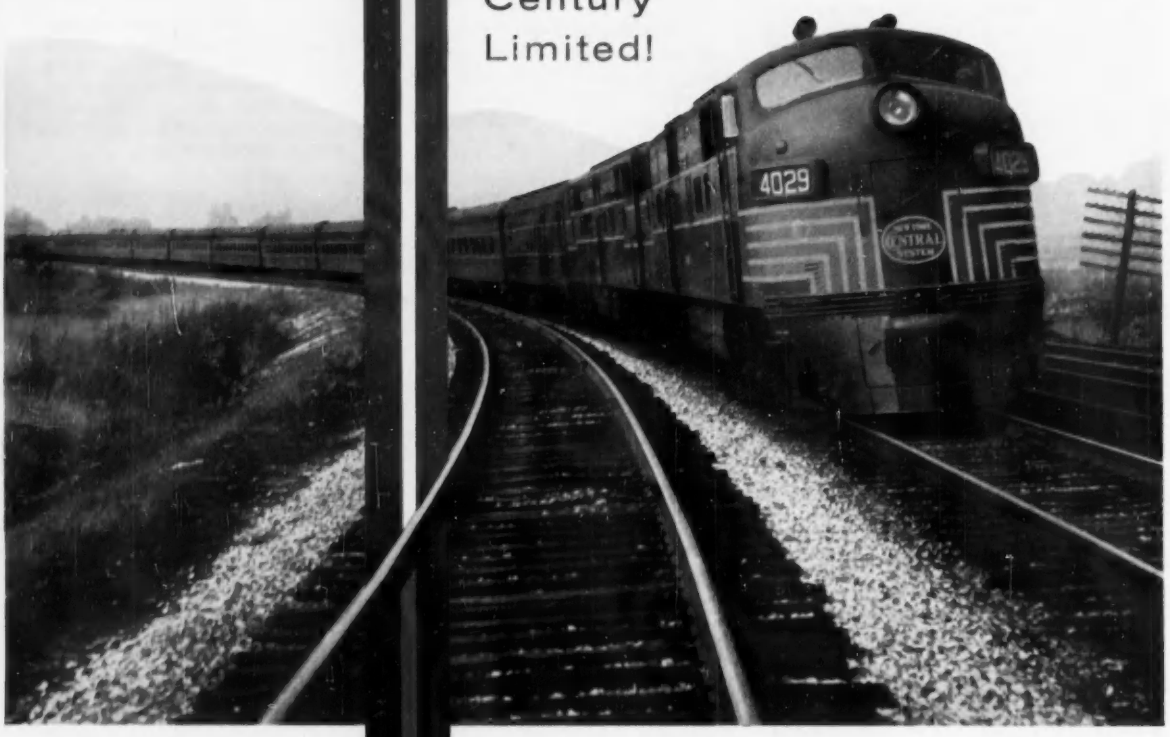
QUALITY PETROLEUM PRODUCTS

TRACKS DOWN THE HEAT...

on the Twentieth Century Limited!



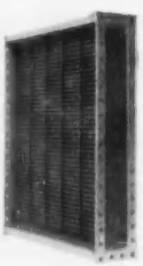
HARRISON KEEPS THE ENGINE COOL

on New York Central's crack train!

The Century takes sizzling, split-second schedules in stride! Making the blazing run from New York to the Windy City . . . this train never runs a temperature. It's prepared for peak performance with Harrison heavy-duty lube oil and jacket water coolers. Harrison coolers are durable, dependable, compact . . . designed for duty on the most advanced diesel engines. That's why the majority of today's modern locomotives specify Harrison to control the heat. If you have a cooling problem, look to Harrison for the answer.

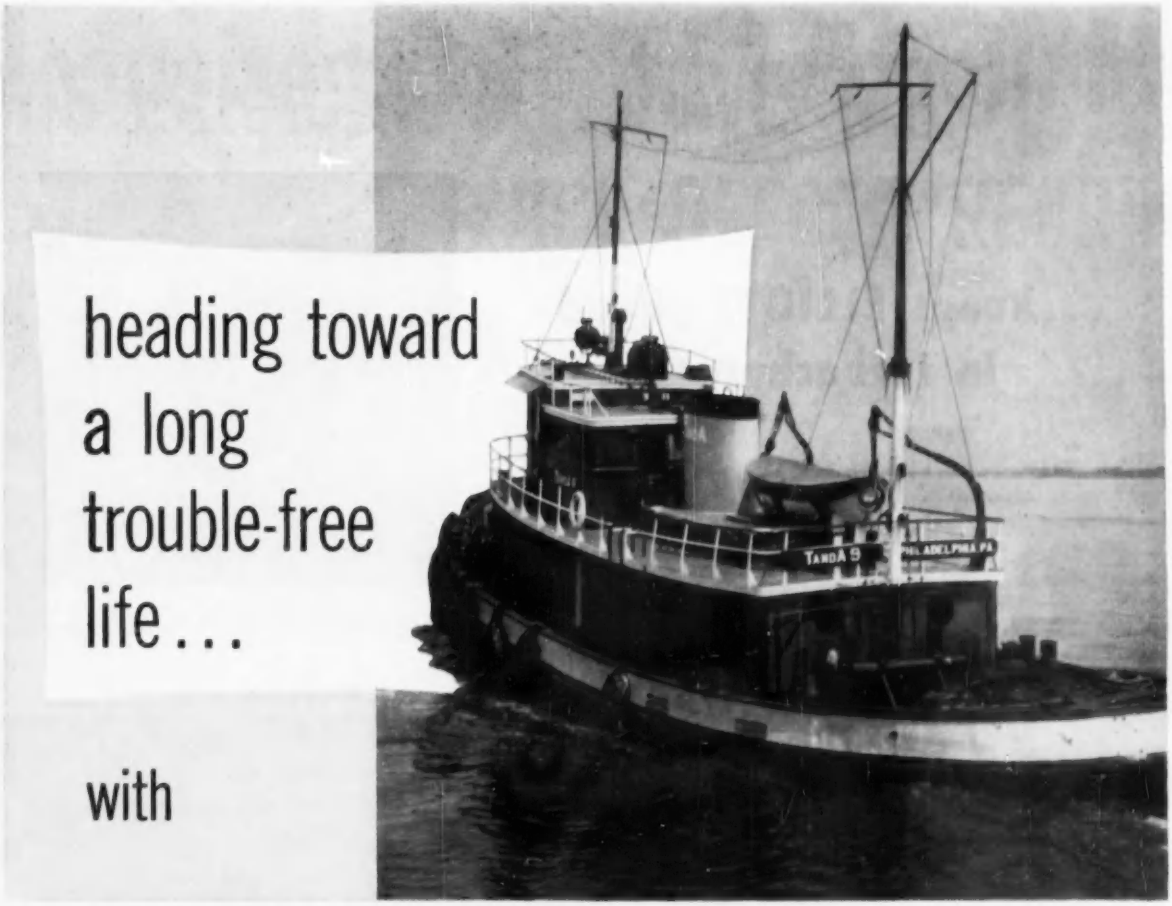
HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

GM **Watch "WIDE, WIDE WORLD" Sundays on NBC-TV**



TEMPERATURES MADE TO ORDER

HARRISON



GULF DIESELMOTIVE and GULF DIESELECT

The powerful Atlas-Imperial Engine in this tug of the Taylor & Anderson Towing & Lighterage Company, Philadelphia, Pa., is on a true course toward dependable and economical operation with the ideal combination for workboat diesels —Gulf Dieselmotive and Gulf Dieselect.

GULF DIESELMOTIVE—the lubricating oil that has an unmatched record of low maintenance costs in this tough service. Here's why: Chosen for their ability to prevent hard carbon deposits in hot spots, the selected base stocks of Dieselmotive oil also provide an oxidation resistance safety factor. Its 100% solvent refining (which removes undesirable constituents) guarantees greater stability and more effective bearing protection. And Dieselmotive's superior additive response is obtained by carefully matching the additives to the base stocks. This insures clean rings and grooves, a minimum of piston crown deposits.

GULF DIESELECT—the straight run distillate fuel that burns evenly and completely, thus contributing further to engine cleanliness. And Gulf Dieselect has a high Cetane Index to assure good combustion at all speeds.

This combination of top quality lubricating and fuel oils can deliver more hours of operation between ring jobs, and lower maintenance costs for your fleet.

Contact your nearest Gulf office for more complete information on these quality products.

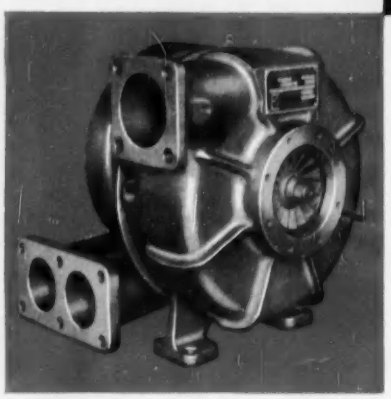
GULF

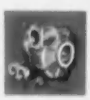
GULF OIL CORPORATION • GULF REFINING COMPANY
1822 Gulf Building, Pittsburgh 30, Pa.

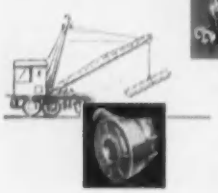
THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

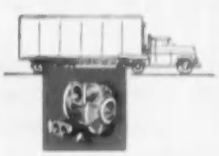
Millions of hp of Experience!

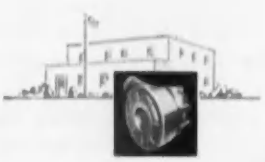
...keeps ELLIOTT ahead in turbochargers

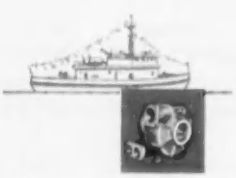


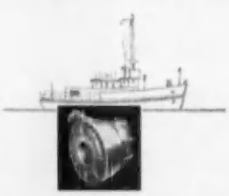












Elliott has a background of more than 16 years experience in DESIGNING, MANUFACTURING and APPLYING turbochargers to diesel engines. During this time, millions of horsepower of diesel engines have been turbocharged by Elliott. These turbocharged engines cover the field—stationary plants, large motorships, fishing vessels, luxurious yachts, railroad locomotives, trucks, off highway tractors, well drilling rigs, etc.

This experience means added assurance of dependability in turbocharged diesel engine performance. Make sure your next diesel engine has a "performance-proven" Elliott turbocharger.

ELLIOTT Company

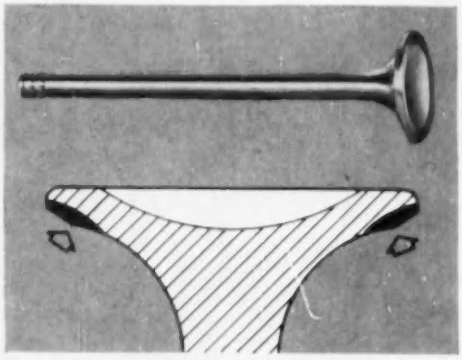
JEANNETTE, PENNSYLVANIA

MG-1

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

Electro-Motive Parts Progress

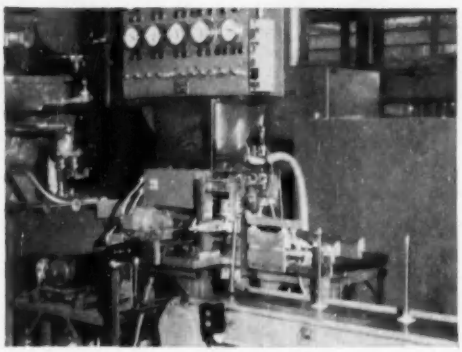
THIS EXHAUST VALVE AVERAGES TWO YEARS SERVICE BEFORE REGRIND



Reasons:

1 *Engine's choice*

Experience has taught us that an engine dictates its own valve needs. Our Model 567 Diesel proved this when previous valve designs of other engines were tried. Exhaustive testing produced the valve shown here, which in normal passenger or freight service runs two years before seat and face regrind. Cutaway view shows special hard Stellite face on valves dictated by our higher horsepower 567C Diesel.



2 *Exclusive manufacture and inspection process*

Manufactured almost entirely by automatic machines, Electro-Motive valves are held to extremely close tolerances. Guarding this precision is a battery of automatic and visual "in-process" inspection controls that assure constant quality and absolute machining accuracy. An example is this electronic machine which checks 14 tolerances at one time on every valve.

3 *Protective packaging*

This special package is used to protect the finely machined surfaces of the valve during handling. Each valve is fitted snugly and protected against moisture with rust preventative V.P.I. paper. Packing like this keeps the valves in perfect condition, always ready for immediate use, and far easier to handle and store.

Continuing improvement is an unending program at Electro-Motive to bring you products of highest quality at lowest cost. When you buy General Motors Diesel parts you get components that are designed, engineered and built to work together. In addition, you benefit with a full warranty and convenient, fast delivery from nine strategically located Electro-Motive warehouses.

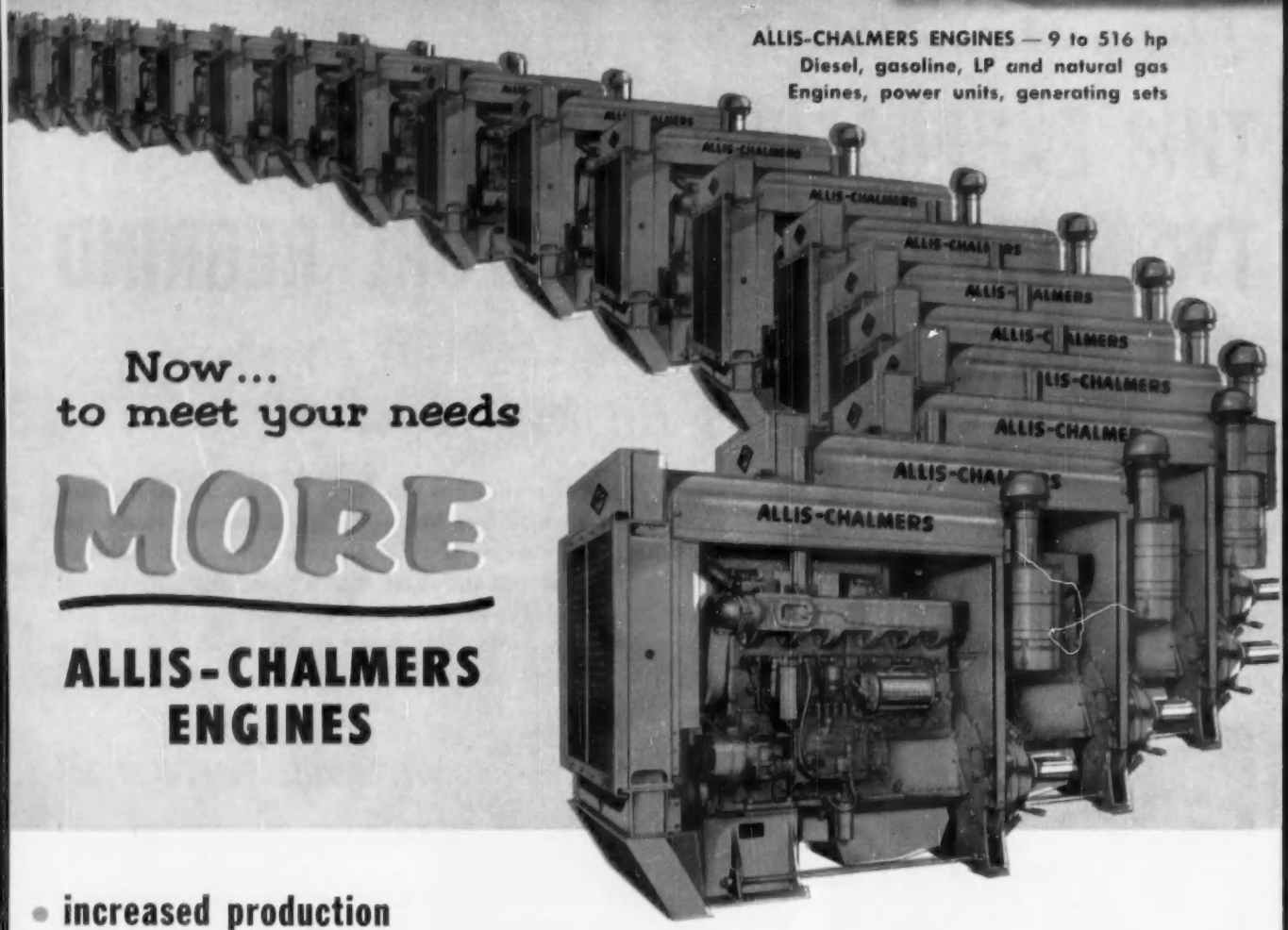
GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS • *HOME OF THE DIESEL LOCOMOTIVE*

In Canada: General Motors Diesel, Ltd., London, Ontario

ALLIS-CHALMERS ENGINES — 9 to 516 hp
Diesel, gasoline, LP and natural gas
Engines, power units, generating sets



Now... to meet your needs

MORE

ALLIS-CHALMERS ENGINES

- **increased production**
- **improved standards**
- **expanded service**
- **greater parts availability**
- **more parts interchangeability**

The production of Allis-Chalmers engines goes up, up, up to meet your needs. The 1956 production is expected to reach an all-time high — and 1955 output was many percent greater than 1954's. A multi-million-dollar expansion of facilities will further boost production.

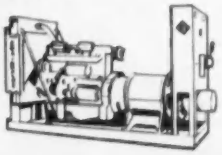
But there are not only *more* engines to meet your needs, there are *better* engines — as Allis-Chalmers research and development continues to pioneer improvements, and as production and inspection standards are set even higher.

Along with this comes an expansion of customer service and greater parts availability, too, as sources of parts and service are moved closer to you.

More and more, it's Allis-Chalmers engines and service to meet your needs.

ALLIS-CHALMERS, BUDA DIVISION, MILWAUKEE 1, WISCONSIN

A complete line of improved engine generator sets from 5 to 300 kw, for emergency and continuous duty, for marine, cooling tower and industrial use.



1954	
1955	
1956 Estimated	

The 1956 production of Allis-Chalmers engines will reach an all-time high, with output many percent higher than in previous years.

ALLIS-CHALMERS

BE-3

for **greater load flexibility** with **top performance**

this

WORTHINGTON SUTC GAS ENGINE COMPRESSOR

is equipped with

BROWN BOVERI TURBO-CHARGERS

A typical Brown Boveri Turbo-Charger. Available in various sizes for charged outputs from about 100 to 6,000 BPH, 4- or 2-cycle service.

advantages of BROWN BOVERI exhaust gas TURBO-CHARGERS

- Continuous power increases of 100% or more.
- No increase in operating costs since chargers' turbines run on exhaust gases supplied by engine.
- 40% and more reduction in space and weight per HP of supercharged engine.
- Self-contained lubricating system eliminates special oil piping outside the engine.
- Air pressure equalization prevents pollution of blower wheel and bearings.
- Ideal for use at high altitudes, too, since pressures can be increased to that of sea level operation.
- Only Brown Boveri offers engineering design and application assistance of internationally recognized specialists in turbo-chargers.

KNOWN as the Worthington Turbo-Uniflo gas engine compressor, this unit is the direct result of over 4 years of research and field tests. The new design embodies a 2-cycle spark-ignition gas engine compressor with completely independent exhaust gas driven turbo-chargers. The Uniflo scavenging makes possible self-sustaining turbo-charging at any load and speed.

Any engine which is Brown Boveri turbo-charged represents the combined engineering efforts of the engine manufacturer's staff and Brown Boveri turbo-charger specialists — another reason for their overall operating efficiency and economy.

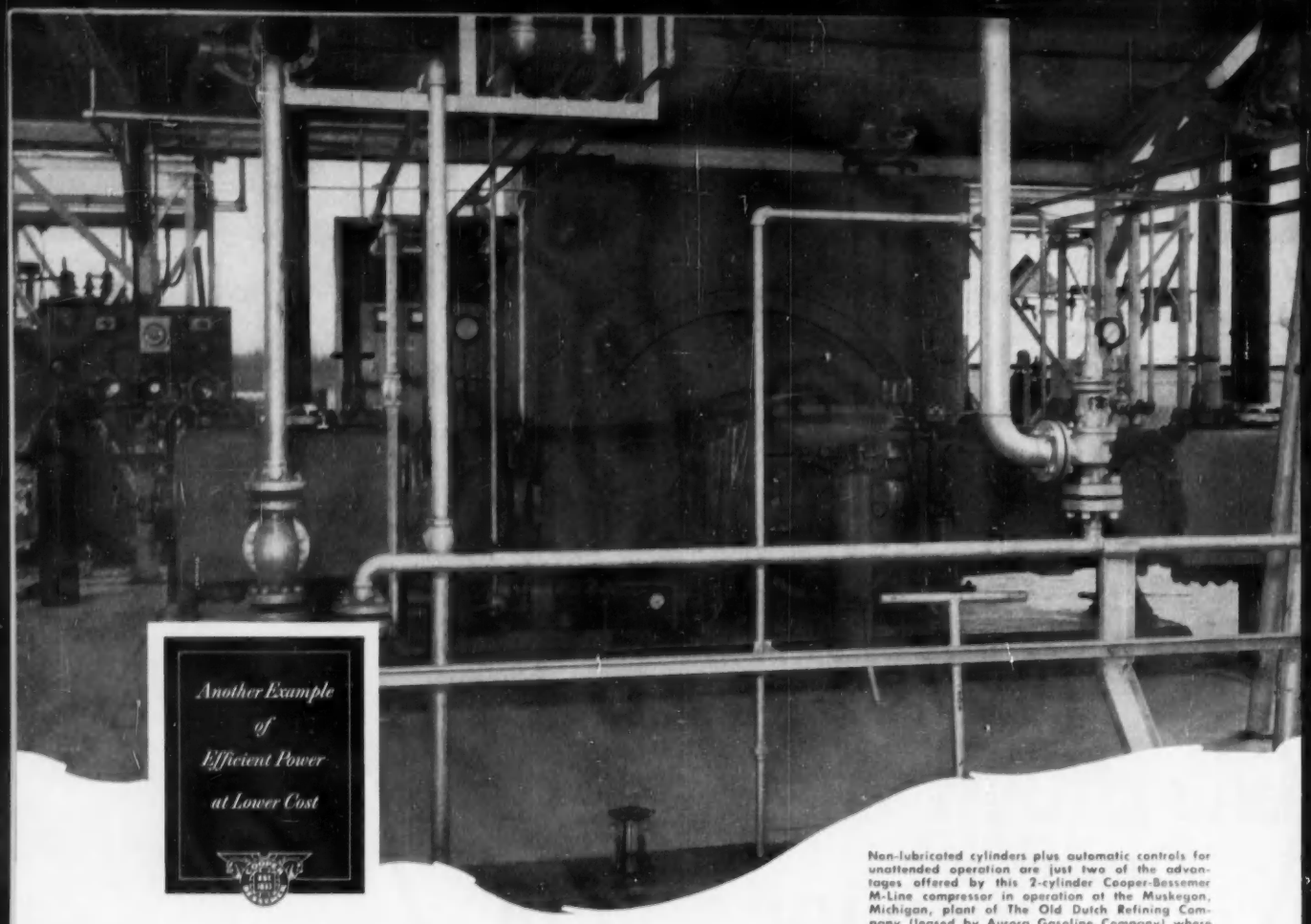
Remember — a Brown Boveri exhaust gas turbo-charger can improve the performance of your gas or diesel engine. Write for more details.

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Buffalo, N. Y. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. • Detroit, Mich. Hamilton, O. • High Point, N. C. • Houston, Tex. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Miami, Fla. • Minneapolis, Minn. New Orleans, La. • New York, N. Y. • Pasadena, Cal. • Portland, Ore. • Roanoke, Va. • San Francisco, Cal. • Seattle, Wash. • Syracuse, N. Y. • Tucson, Ariz.

BROWN BOVERI



Non-lubricated cylinders plus automatic controls for unattended operation are just two of the advantages offered by this 2-cylinder Cooper-Bessemer M-Line compressor in operation at the Muskegon, Michigan, plant of The Old Dutch Refining Company (leased by Aurora Gasoline Company) where the UOP Platforming process is in use.

"HYDROGEN COMPRESSES CLEAN"

... with Cooper-Bessemer's non-lubricated cylinders

RECYCLING millions of cubic feet of hydrogen a day for the UOP Platforming of low-octane gasoline, demands continuing efficiency from a smooth working compressor that will not contaminate the recycle hydrogen. That is one of the reasons why The Old Dutch Refining Company, leased by Aurora Gasoline Company, recently installed a 2-cylinder Cooper-Bessemer FM compressor in their modern plant in Muskegon, Michigan.

To avoid contaminating hydrogen with oil in the recycle gas, Cooper-Bessemer successfully developed a non-lubricated compressor cylinder.

Operating against micro-smooth hardened cylinder liners, these 8" diameter carbon pistons require no lubrication whatever. With a mirror finish, the cylinder bores reveal no excessive wear.

No matter how exacting or complex your compressor problems, check the advantages offered by Cooper-Bessemer M-Line compressors. For dependability and money-saving operation, you can rely on Cooper-Bessemer — one of America's oldest engine builders offering the latest in engineering advancements.

MOUNT VERNON, OHIO

COOPER-BESSEMER

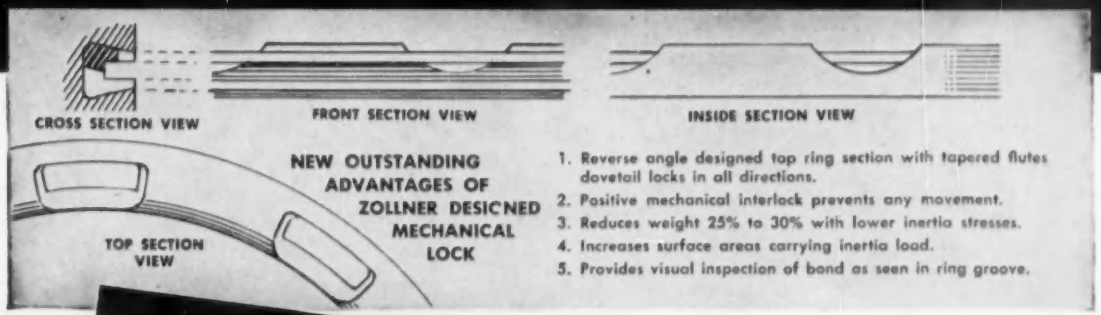
GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

BOND-O-LOC* PISTONS

WITH "NI-RESIST" IRON TOP RING SECTION


CROSS SECTION VIEW
FRONT SECTION VIEW
INSIDE SECTION VIEW
TOP SECTION VIEW
NEW OUTSTANDING ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK
1. Reverse angle designed top ring section with tapered flutes dovetail locks in all directions.
2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.
5. Provides visual inspection of bond as seen in ring groove.

Double Bonded

METALLURGICALLY Al-Fin Bond

MECHANICALLY Zollner Lock

STOPS!

RING GROOVE WEAR IN HEAVY DUTY SERVICE

"Sensational mileage" is the unanimous report of heavy duty engine builders and transport operators using Zollner "Bond-O-Loc" Pistons. Another great development by Zollner engineers, this super-mileage piston has a "Ni-resist" top ring groove section *permanently* incorporated with the *double* bond of *both* Al-Fin metallurgic *and* the exclusive Zollner mechanical lock. Separation failure is impossible. Ring groove wear problems are eliminated, blow-by prevented, oil consumption minimized, mileage to overhauls greatly increased. We suggest an immediate test of these sensational advantages for your engine.

Licensed under Patents 2,396,730; 2,455,457; 2,550,879

*T. M. Reg. Pat. App. For

ADVANCED ENGINEERING

PRECISION PRODUCTION

COOPERATION with Engine Builders

ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

ZOLLNER • Fort Wayne, Indiana

Monmouth*

MICRO* AND CLEVITE* 77 BEARINGS...

you can't install greater engineering, precision and performance!

Monmouth bearing qualities can back up your desire to provide the finest of engine repair service. Why? Because they are the product of the world's leading manufacturer of automotive engine bearings . . . and you benefit by the most advanced bearing engineering and bearing manufacturing techniques known today.

You can quickly get Monmouth Micro or Clevite 77 bearings that are precisely right for any car, truck, bus or tractor. Available from N.A.P.A. jobbers coast to coast.

*The words Monmouth, Clevite and Micro are registered trade marks of Clevite Corporation

Monmouth

TRADE MARK

ENGINE BEARINGS

Clevite Service
The Cleveland Graphite Bronze Co.
Division of Clevite Corporation, Cleveland, Ohio, U. S. A.

NAPA
Assurance of Quality

Your NAPA Jobber is a Good Man to Know!

HERE'S YOUR ASSURANCE POLICY FOR LOWEST FLEET OPERATING COSTS

Now PURE puts more pay-off in your preventive maintenance with a

NEW COMPLETE PURE-SURE USED OIL ANALYSIS PLAN

Cuts your fleet mileage costs by telling you what to do to reduce downtime and overhauls

Now at last here's an assurance policy that helps your Preventive Maintenance efforts pay off big in reduced fleet operating costs. It's the new complete *Pure-sure Used Oil Analysis Plan*—another industry first from Pure Oil.

Actually, the Pure-sure Used Oil Analysis Plan is twofold in scope, consisting of Lab Checks and Spot Checks on your used crankcase oil. This new Pure-sure service tool will enable you to reduce downtime maintenance and repair costs six ways:

1. The "Lab Check" of your used oils tells you of the general mechanical condition of your engines and gives you a check on how your P.M. System is working.
2. The "Lab Check" reveals conditions that reduce the engine life and cause premature failures which result in road calls and unscheduled downtime.
3. The "Lab Check" points up conditions that result in excessive fuel and lube expenses.
4. The "Spot Check" of your used oils quickly tells you when to drain the oil from each unit at the moment it needs changing rather than on some set time or mileage basis.
5. The "Spot Check" made on a day-to-day or trip basis will indicate sudden changes in engine condition that would cause breakdown if not corrected.
6. The "Spot Check" will show up leakage from the cooling system into the crankcase in time to repair leaks before engine parts are ruined.

Yes, the Pure-sure "Lab Check" and "Spot Check" Used Oil Analysis Plan is the "stitch in time that saves nine."

Best of all, the *Pure-sure Used Oil Analysis Plan* is FREE to PURE Fleet customers. But you'll know what it's really worth by the money you save in operating costs.

LAB CHECK

Discovers hidden engine troubles *before* they cause downtime and costly repairs

A staff of trained PURE laboratory technicians run more than a dozen checks on every used oil sample you send us. Then a highly skilled automotive engineer is assigned to the interpretation of the results of your sample to detect hidden engine troubles. And from their findings they can give you valuable information that will help you

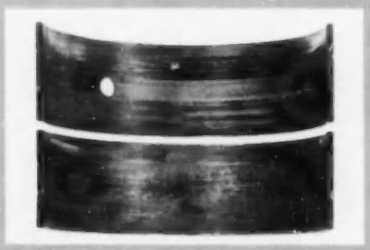
- INCREASE ENGINE LIFE
- CUT OIL COSTS
- CUT FUEL BILLS
- PREVENT FUEL DILUTION PROBLEMS
- PREVENT EXCESSIVE ENGINE WEAR
- PREVENT MANY ON-THE-ROAD ENGINE FAILURES
- USE OIL FILTERS MOST EFFECTIVELY

SPOT CHECK

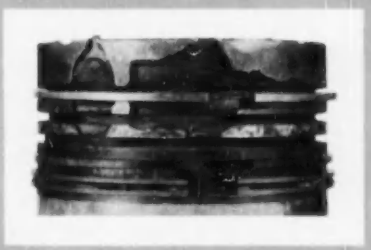
Great new "Spot Check" Analysis confirms maximum safe drain periods in two minutes

PURE'S new "Spot Check" enables you to tell how dirty your crankcase oil is—in just two minutes. It gives you more for your oil dollar by establishing the maximum safe drain period for each of your fleet units. And it protects your engines from damage by letting you know when crankcase oil can no longer be used without risk. Comparisions of spots from the same engine over a period of time give warning of trouble-making conditions that may cause expensive repairs. It's as easy to use as a dipstick is to read and anybody working in your shop can become an expert.

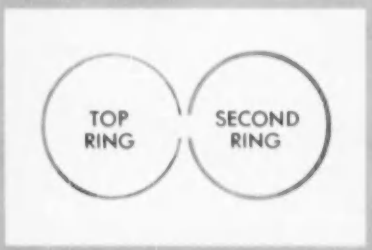
PURE'S "Lab Check" extends time between your engine overhauls by foreseeing this kind of trouble



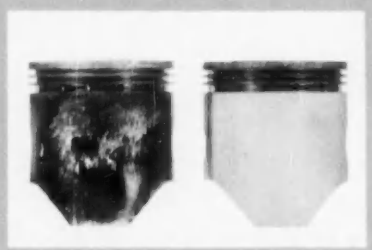
Pure's "Lab Check" Analysis will show traces of bearing metals in the used oil in time to prevent complete bearing failure or crankshaft scoring like this one, or excessive engine wear caused by metal fragments in oil.



Excessively high temperature or dirt can cause damage like this piston failure. Such conditions can be exposed in advance by "Lab Check" Analysis.



Dust wore out this set of piston rings in 6,000 miles. Dust and fine iron particles in the oil revealed by "Lab Check" Analysis would permit operator to correct the trouble long before the actual failure.



These varnish deposits were caused by a poorly ventilated crankcase, a condition that could have been spotted and corrected by "Lab Check" Analysis.

Excessive fuel dilution can cause scored cylinder walls and excessive wear of other parts as well as reduce gasoline mileage. "Lab Check" Analysis will point out this trouble-maker well in advance of serious engine damage.

Clogged filter elements can't protect the engine parts from wear. Use "Lab Check" Analysis to detect this condition and help you increase engine life.

HOW IT WORKS

1. Make sure oil sample is hot. Take sample right after a run or if oil is cool run engine prior to test.

2. Withdraw dipstick and transfer a drop of oil to sampling rod.

3. Place drop of oil on special oil test paper from sampling rod and allow to spread.

4. Compare oil spot with representative spots on "Spot Check" folder. Follow instructions under matching sample to see if oil needs changing. If radical deviations are noted in oil spots from earlier checks, drain oil and send in pint sample for "Lab Check" analysis.

START CUTTING OPERATING COSTS NOW WITH THE **NEW PURE PLAN!**

Now's the time to start cutting your fleet mileage costs. And it's this easy with the new PURE Plan:

1. Get a PURE "Lab Check" Analysis of a cross section of your fleet. This "Lab Check" will tell you of general conditions that (1) may be costing you many dollars in fuel and lube expenses and (2) may lead to unexpected road breakdowns. Then your men can handle any necessary maintenance work long before it reaches the critical stage.

2. Use the PURE "Spot Check" on all engines to learn when the oil should be changed and to get other inside information. Radical changes that show up in "Spot Check" Analysis will be the tip-off that an engine needs special attention. Follow up with a "Lab Check" Analysis to find out what has gone wrong.

Count on your local Pure Oil Representative to put the new PURE Plan in operation.

Here's the product that gives you full benefits from the PURE Plan!

PUROL
HEAVY DUTY
MOTOR OIL

Made especially for tough truck use

This is the product—Purol H.D., the truck-tested oil—that pairs up with the Pure-sure Used Oil Analysis Plan to cut your fleet operating costs to a new all-time low. This rough, tough, friction-fighting heavy duty motor oil is made especially for truck engine service! It was designed from crude oil to crankcase to give better performance and to cut both lubrication and maintenance costs.

Here's what this great oil does for you:

- Helps your hard-working, heavy-duty gasoline and diesel engines deliver all of the horsepower built into them—because it keeps your engines clean and fights friction.
- Provides more miles between overhaul jobs because its tough film keeps engine wear down.
- It is economical to use. Thousands of fleet operators have found they have to add less Purol Heavy Duty Motor Oil between changes.

For full information on the Pure-sure Used Oil Analysis Plan and this truck-tested motor oil call your local Pure Oil Representative today.

THE PURE OIL COMPANY, DEPT. 1652
35 EAST WACKER DRIVE, CHICAGO 1, ILLINOIS

Without cost or obligation, please send information on obtaining a Pure-sure Used Oil Analysis for one of my fleet units.

Name_____

Title_____

Company_____

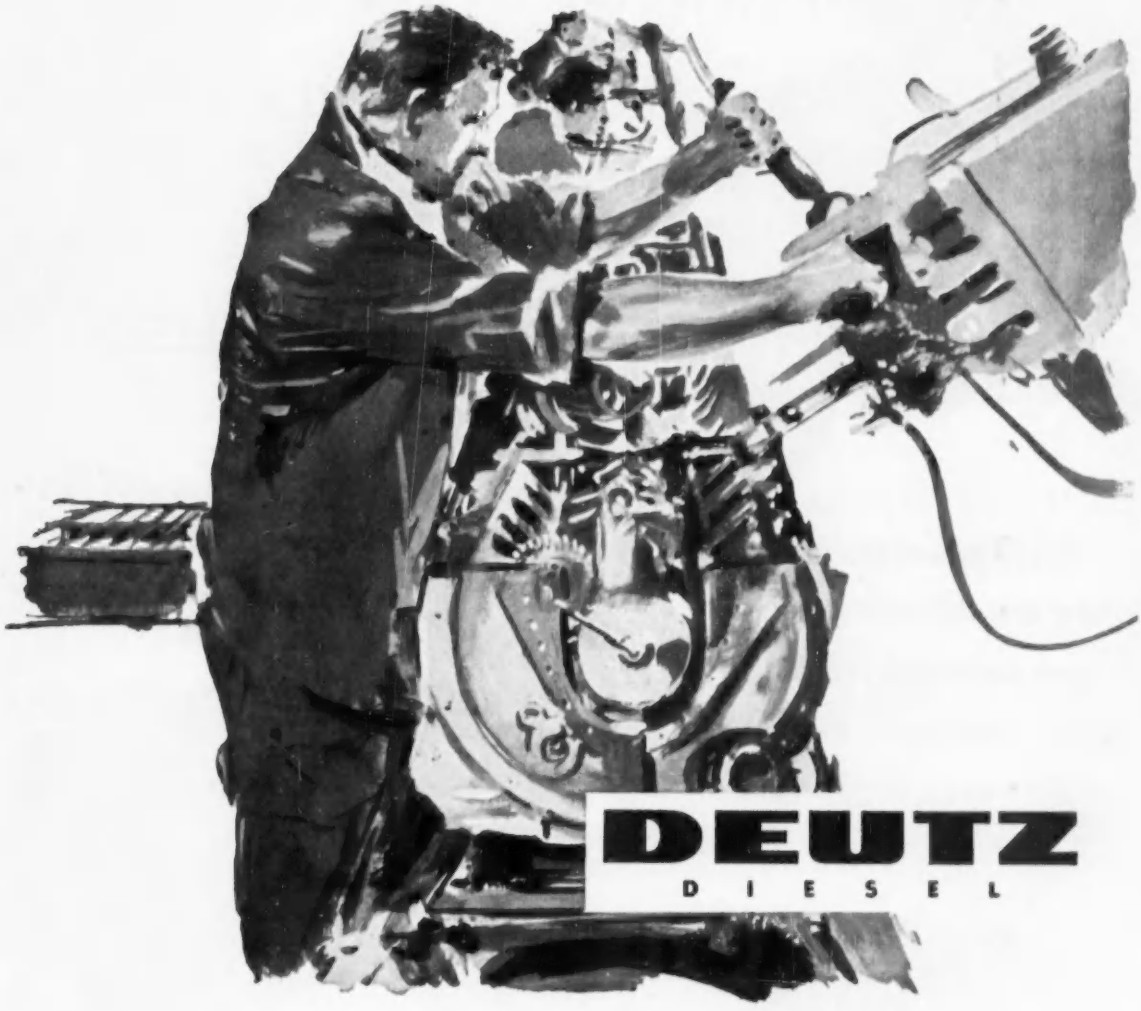
Street_____

City_____ Zone____ State_____

BE SURE PURE WITH PURE

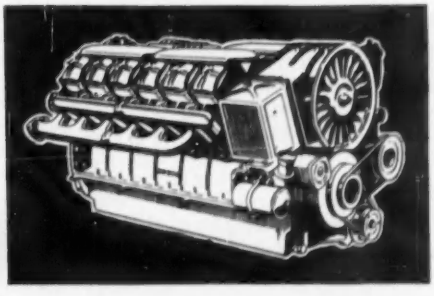
Be sure with PURE

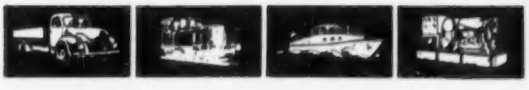
626



air-cooled

began in 1948 to build air-cooled diesel engines in large series. 7 years after, in 1955, the oldest engine manufacturers in the world had built and sold 150.000 air-cooled DEUTZ diesel engines totalling 7.5 Million B.H.P. These equipment engines are used all over the world for every kind of application. DEUTZ builds air-cooled 1 to 12-cylinder diesel engines with an output range from 5 to 250 B.H.P. for road vehicles, rail vehicles, water craft, working machines in all fields of application, generator sets for stationary and mobile electric and power plants.





KLÖCKNER-HUMBOLDT-DEUTZ AG. KÖLN

GERMANY

U. S. REPRESENTATIVE: DIESEL ENERGY CORPORATION, 82 BEAVER STREET, NEW YORK 4, N. Y.

advanced design in turbochargers means... air-cooling!

AiResearch turbochargers possess this all-important characteristic

There's little quarrel in the diesel industry about the air-cooling principle being highly-desirable in a turbocharger. It eliminates the need for extra plumbing on installation, puts no additional burden on an engine's cooling system and makes for a lighter, smaller unit in relation to output.

AiResearch turbochargers now available have been designed on this principle — which promises to be universal in the future. In addition, our units increase power up to 100% depending on design and application of your engine, cut fuel costs, reduce noise and decrease or eliminate smoking. The removable rotating assembly makes them easier to maintain than other turbochargers.

We invite your inquiry on how you can improve the performance of your diesels by the application of our turbochargers.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

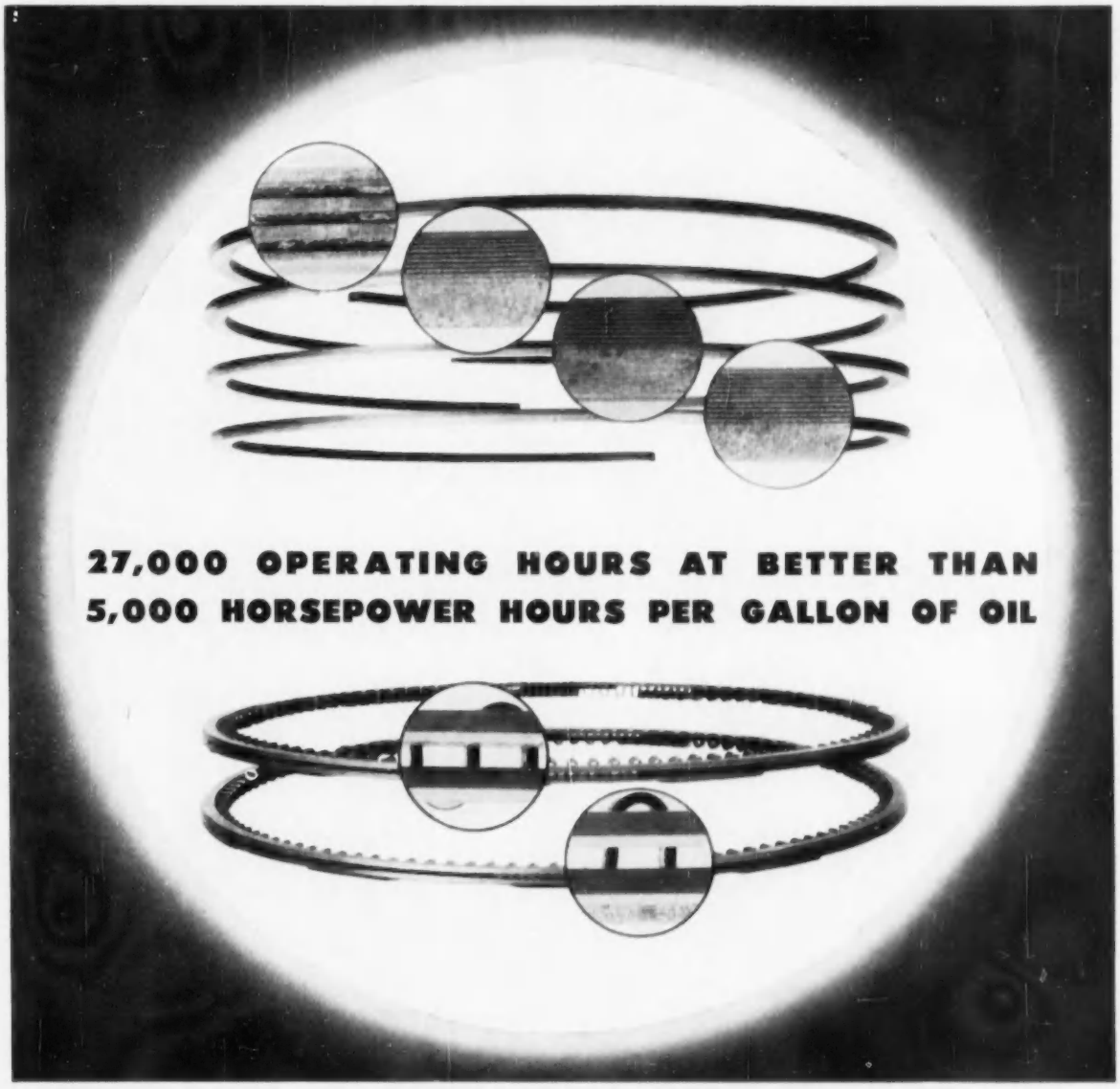
MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min. (Standard Conditions)	25-40	35-65	35-65	70-95	115-175

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS



27,000 OPERATING HOURS AT BETTER THAN 5,000 HORSEPOWER HOURS PER GALLON OF OIL

ENGINEERED RING SETS IS A PEDRICK FIRST

In 1921, the first complete set of rings in a single package, engineered for a particular internal-combustion engine, was introduced *by Pedrick*. You get 35 years of experience and know-how, therefore, in the complete sets we engineer for diesel and gas engines.

That's part of the reason Pedrick Engineered Sets give the kind of performance revealed by the un-retouched photo above. These rings are from a Pedrick E3902 Set taken out of a Cooper-Bessemer GMV engine after 27,109 hours of operation. Oil consumption averaged better than 5,000 hp. hrs. per gal. Wear in the cylinders was almost insignificant—averaging only .00725 in. at the top and .0035 in. at the bottom. Ring tension remains at practically original production level. Each ring shows face-wear only about halfway up, so rings still are practically as good as *new!*

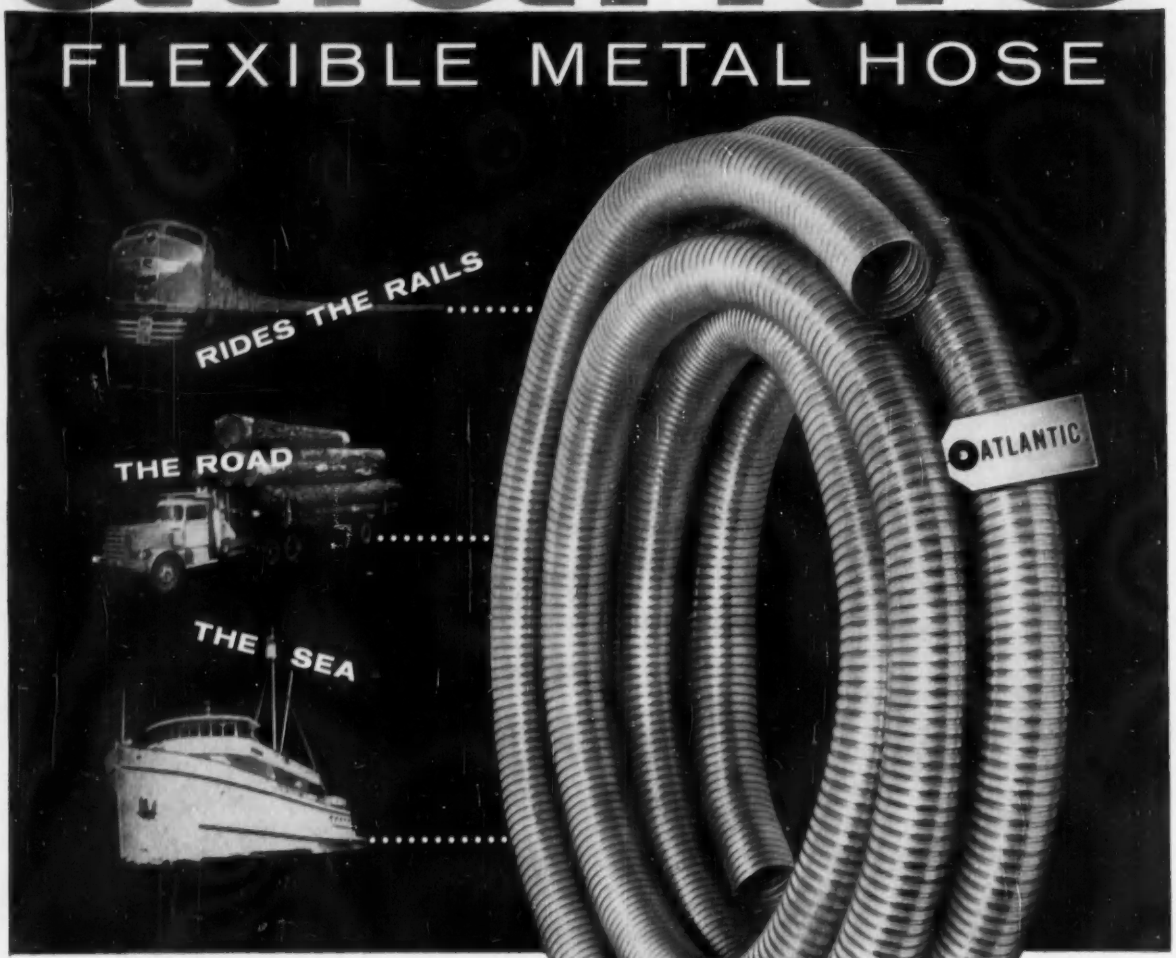
For *your* engine's own good, use Pedrick Engineered Sets with the latest ring designs in proper combination, illustrated installation instructions, a single package per cylinder. You'll also enjoy the benefits of simplicity in ordering and stocking. The same engineering know-how which goes into Pedrick Engineered Sets is available to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Toronto 2.

Pedrick HEAT-SHAPED PISTON RINGS

PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

atlantic

FLEXIBLE METAL HOSE

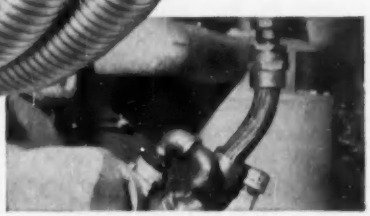


When diesels power trucks hauling 70,000 lb. loads of logs over mountain roads—or locomotives and ships, Atlantic flexible metal hose is usually given the job of guarding those vital diesel life lines—water, fuel, exhaust.

Atlantic flexible metal hose is manufactured to tough specifications.

Wall thickness is absolutely uniform. Tight against water, oil, steam, gas and air. Requires no maintenance. Atlantic flexible metal hose dampens vibration, remains flexible at higher temperatures.

There is an Atlantic flexible metal hose for each of these applications. Made in bronze, steel, stainless and monel—⅛"-36" I.D. with required fittings.



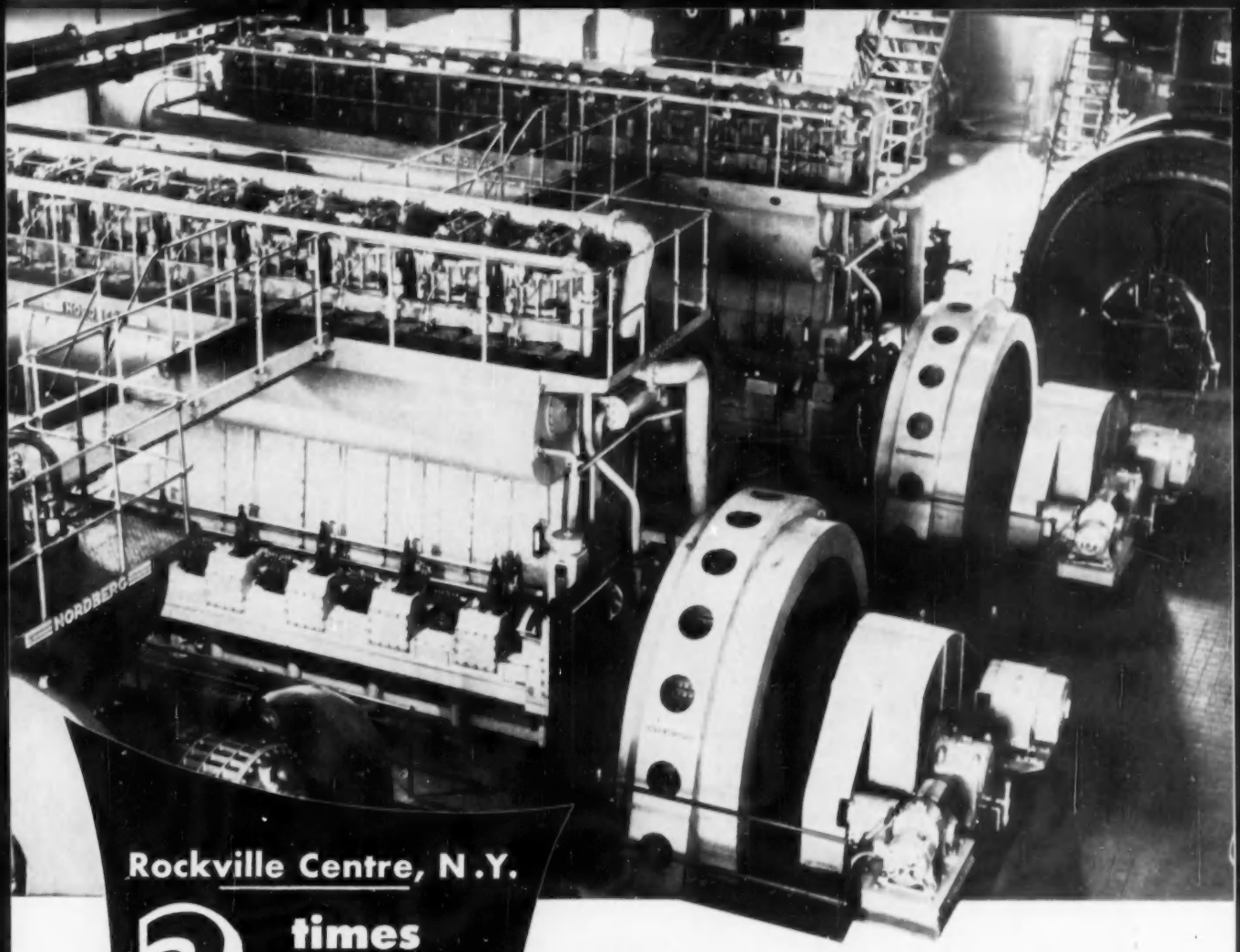
For misalignment and vibration

JOB TESTED CERTIFIED

Write for Diesel Bulletins 1020 & 50A. See our Catalog in Sweet's Product Design File.

ATLANTIC METAL HOSE CO., INC.

309 DYCKMAN ST., NEW YORK 34, N. Y.



Rockville Centre, N.Y.

3 times the power in the Same Space with NORDBERG DIESELS

Plant Reports Fuel Consumption of 14.77 KWH per gallon on NEW NORDBERG ENGINES

• Experience of the City of Rockville Centre, Long Island, N. Y., is evidence of the ability of Nordberg Diesels to meet increasing power requirements at low cost.

From their first small generator, installed in 1898, the present modern power plant has evolved . . . going from steam to diesel in 1927. By 1930, four diesels totaling 4600 hp occupied the entire original plant. These engines more than amortized themselves and are now gone. Today, four big Nordberg Diesels totaling 15,850 hp have replaced them in the Rockville Centre plant . . . *and occupy the same space as did the original four engines which produced only 4600 h.p*

Based on the excellent performance of the first two Nordberg engines, two more Nordberg units were installed in 1954. In referring to the performance of these units, Mr. C. P. Ketler, Chief Engineer, Public Utilities, Rockville Centre, writes . . . *"the kilowatt hours generated (in 1955) by the two 4500 hp Nordberg Diesels were 30,872,000, with a fuel consumption of 2,090,132 . . . or 14.77 KWH per gallon."*

Here is real proof of the installation and operating economy of Nordberg engines in modern power generation service. Write for further information, outlining your power requirements.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

•

Builders of America's Largest Line of Heavy Duty Engines . . . 10 to over 12,000 hp.

NORDBERG
DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

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P656

Let the THOMAS NELSON *Speak for Herself*

The economy of operating high speed diesels and gas turbines with Bunker "C" oil, continuously purified in high efficiency, self-cleaning Sharples Centrifuges is attested by numerous installations on land and sea. You can depend on Sharples wherever purification of oils is a problem or a necessity.

SHARPLES

THE SHARPLES CORPORATION
2300 WESTMORELAND STREET • PHILADELPHIA 40, PENNSYLVANIA
NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON
Associated Companies and Representatives throughout the World

Superintendent E. B. Ogden uses DUALOY pistons for replacement in diesel engines of Consolidated Freightways trailer-truck fleet.

Armored with Ni-Resist top ring bands, DUALOY pistons replaced conventional-type aluminum pistons in the diesel engine powering this doubles combination operated by Consolidated Freightways, Inc., Portland, Ore. DUALOY pistons with Ni-Resist ring carriers are produced by United Engine & Machine Company, San Leandro, Calif.

"We insist on Ni-Resist inserts in our replacement pistons,"

... says E. B. Ogden Superintendent of Maintenance, Consolidated Freightways, Inc.

"... and we plan to continue using DUALOY pistons with NI-RESIST* top ring bands in rebuilding engines in our shops at Portland, Los Angeles, Minneapolis and Chicago."

You, too, can lessen your workload. You can watch your mileage multiply some three-fold between piston overhauls and see ring-groove wear practically vanish.

Put aluminum pistons, with Ni-Resist bonded-in top ring grooves to work in your diesel engines.

The inserts resist metal-to-metal wear and galling. Equally important, they resist attacks from corrosion and heat. In Ni-Resist inserts, your rings function properly, preventing blow-by and abnormal oil consumption. You get a step-up in power. Downtime takes a big tumble.

Ni-Resist, a nickel alloy cast iron, has many diverse uses. Actually, no other cast metal provides such a useful combination of engineering properties. Its applications include cylinder liners, valve guides and exhaust-system parts as well as ring carriers.

If such parts give *you* trouble, let us help you lick it. Fill in the coupon and mail it to us now.

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.
Gentlemen: We're having trouble with
☐ top ring grooves ☐ cylinder liners
☐ valve guides ☐ exhaust manifolds
due to ☐ heat ☐ corrosion ☐ wear
☐ Please send booklet "Keep Them Rolling"

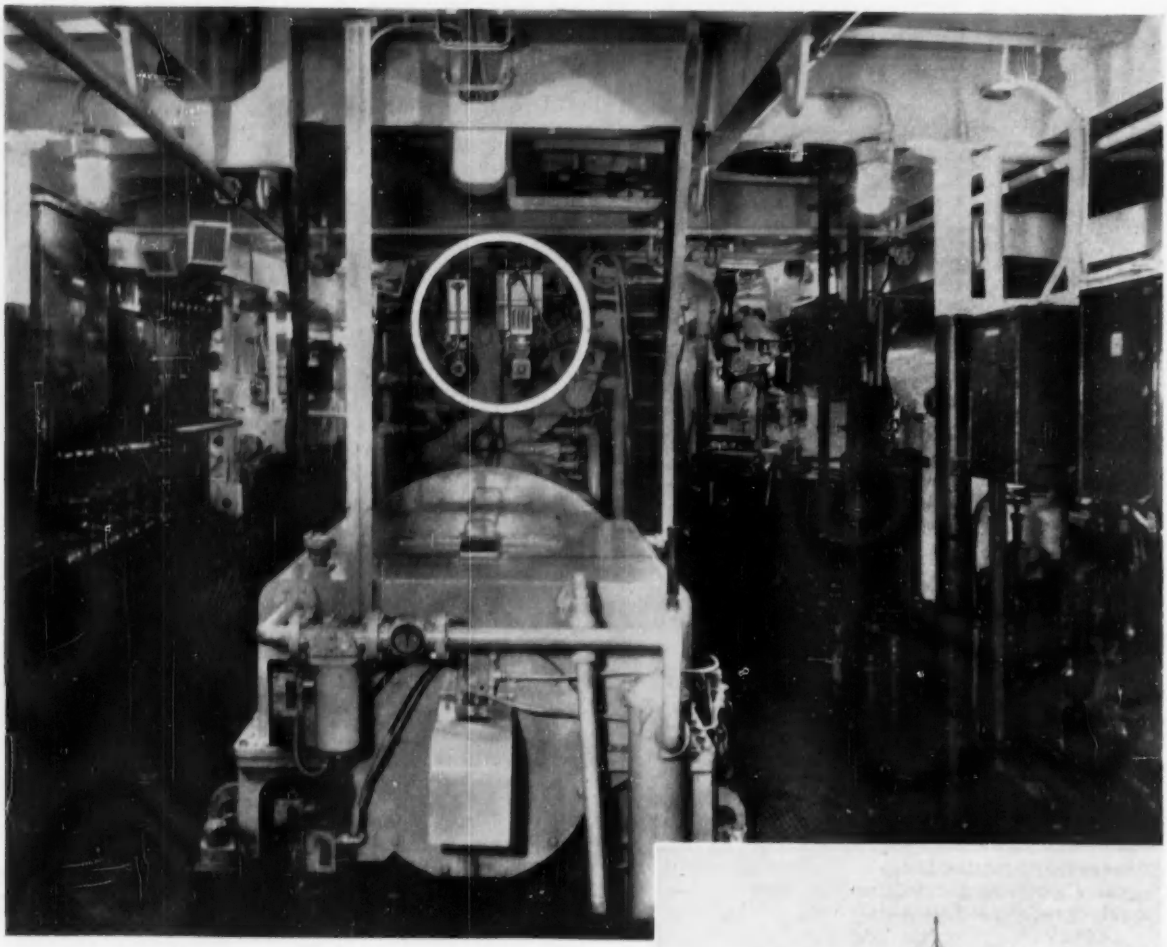
Name _____ Title _____

Company _____

Address _____

City _____ State _____

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.



Marquette

HYDRAULIC GOVERNORS assure all-weather efficiency for heavy duty tug "Grampus"

A Marquette Governor and Overspeed Trip provide accurate and dependable regulation of 1,700 horsepower on this 105-foot tugboat, newest addition to the offshore fleet of the G & H Towing Co., Galveston, Texas.

The "Grampus" is assured of full, steady power under all conditions. Even in stormy weather she can efficiently tackle the biggest jobs.

Marquette Governors are daily proving their dependability and accuracy on thousands of tugboats, river towboats, motor vessels, dredges, ferries, trawlers, freighters, fishing boats and on miscellaneous vessels operated by the United States and foreign governments.

Our engineering facilities are at your disposal for solving all problems of power control—on sea or land.

Massey GOVERNORS

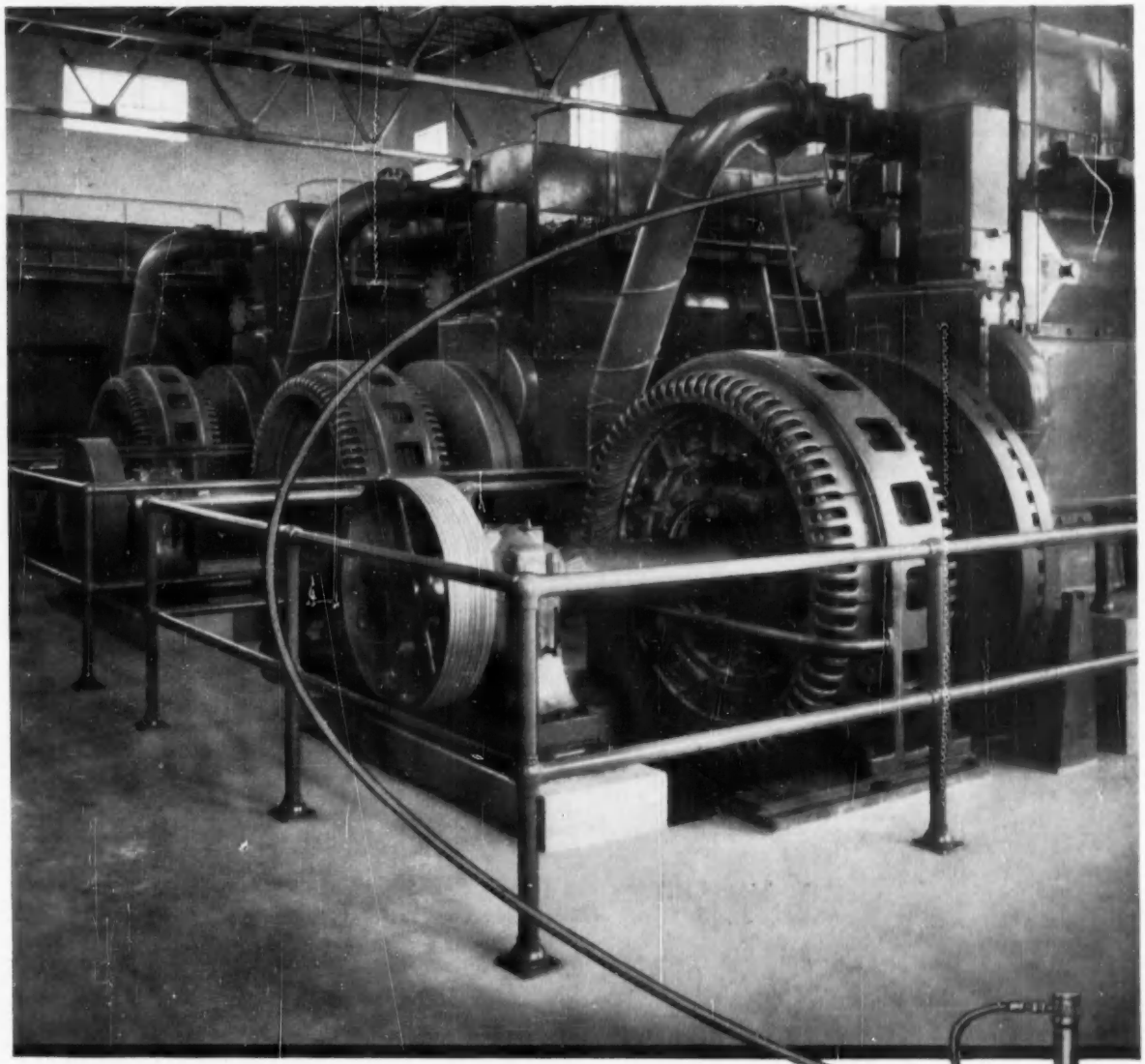
Marquette GOVERNORS

MARQUETTE METAL PRODUCTS DIVISION

CURTISS-WRIGHT

CORPORATION • CLEVELAND 10, OHIO

Other Marquette Products: AIRCRAFT WINDSHIELD WIPERS • ANTI-FRICTION BEARING TEXTILE SPINDLES • SPRING CLUTCHES PRECISION PARTS AND ASSEMBLIES • ROTARY OIL PUMPS

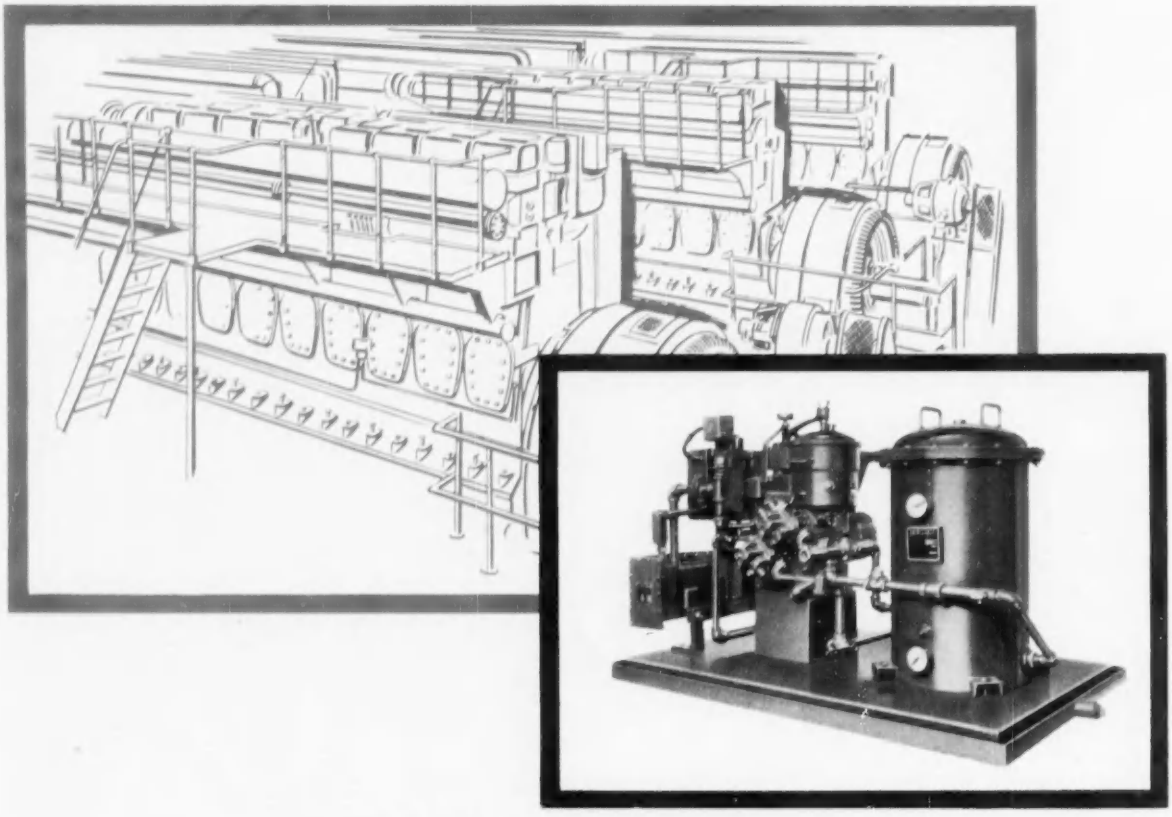


NO STUCK RINGS!

Stop the formation of varnish, sludge and carbon in your Diesels and *keep it stopped* with Sinclair RUBILENE®, the high viscosity index oils proved by over 35 years in industrial Diesel applications. RUBILENE earns its reputation by its performance under continuous operation and heavier loads. It fights deposits and gives better protection to cylinders, pistons, rings and other vital moving parts. Your Diesel stays on the job longer . . . service time is cut 'way 'way down!

Let RUBILENE help solve your lubrication problems. Regardless of the make or age of your Diesel, where a high VI oil is needed, there's a member of Sinclair's RUBILENE or RUBILENE HD family that meets your requirements exactly. Call your local Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Ave., New York 20, N. Y. *There's no obligation.*

SINCLAIR RUBILENE OILS



DE LAVAL "PURI-FILTER" REMOVES IMPURITIES WITH ONE PASS!

The De Laval "Puri-Filter", designed to remove all trouble-making diesel lube oil impurities, provides complete purification in just one pass.

Centrifugal action takes out solid contaminants and water... filters remove colloidal carbon and other minute impurities down to one micron (0.000039") in size. Used oil is restored to "like-new" condition while additives for oil improvement are retained.

A De Laval "Puri-Filter" means longer engine life... fewer over-hauls... reduced ring sticking and bearing wear... increased oil life... simplified maintenance... greater operating economy and efficiency all down the line.

Get all the facts! Write for the "Puri-Filter" Bulletin today!

DE LAVAL
SEPARATOR COMPANY

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

DIESEL ENGINE MANUFACTURERS RECOMMEND.....

SIOUX

VALVE GRINDING MACHINES

When it comes to the big jobs, there's nothing like the SIOUX No. 682 Valve Grinding Machine for ruggedness, speed, precision, and dependability.

The No. 682-L, equipped with lever operated chucks, has capacity with two chucks, for ¼" to 1¼" valve stems, and 6½" valve heads. It takes valves up to 18" long with aligner, no limitation when chuck bushings are used.

A SIOUX No. 682 Valve Grinding Machine is shown grinding valves in head reclamation operations for Diesel locomotives. This picture was taken in the FRISCO Diesel Shop at Springfield, Missouri.

and...

SIOUX

VALVE SEAT GRINDING EQUIPMENT

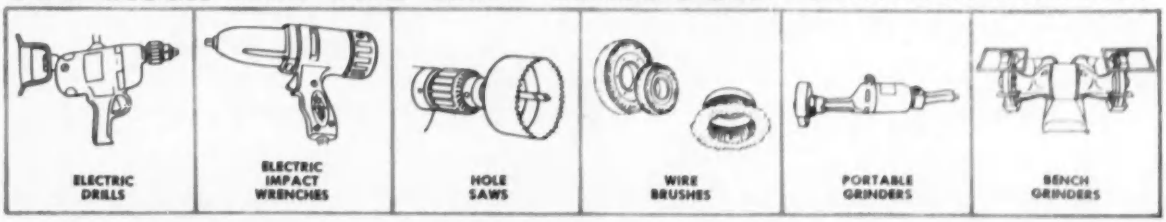
The greatest possible accuracy can be obtained with the SIOUX Dual-Action Valve Seat Grinder and SIOUX Tapered Pilots. SIOUX Tapered Pilots are precision tools and offer the most positive guide known. Dual-action is a controlled fine vibration for grinding and dispersion of the cuttings with the grinding wheel mounted for full contact with the Valve Seat. A perfected system.

Factory approved sets for Allis Chalmers, American Locomotive, Baldwin Locomotive, Case Tractor, Cooper-Bessemer, Ferguson Tractor, General Motors Corp., Hercules Engines, Ingersoll Rand, International Harvester Tractor, International Harvester Truck, John Deere, Massey Harris, Minneapolis-Moline, National Supply, Onan Motors, White Motor Trucks.

LEFT: Heavy Duty Dressing Tool shown with Heavy Duty Driver dressing grinding wheel.

BELOW: Lifting spring is placed on pilot and grinding wheel brought up to speed before grinding.

USE SIOUX ALL THE WAY THROUGH ... *Standard the World Over!*



ALBERTSON & COMPANY, INC. SIOUX CITY, IOWA, U.S.A.

DESIGNER...MANUFACTURER...USER

here's why it'll pay you to specify

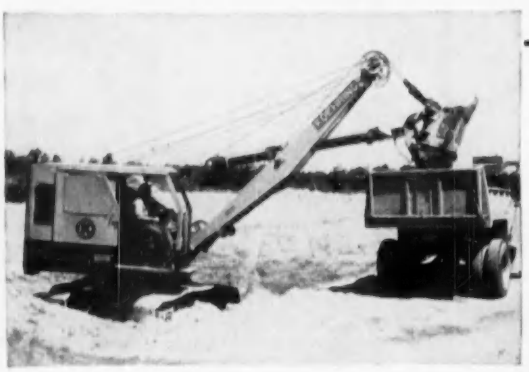
International Power Units

DESIGNER

Your problems of engine power analysis, selection, and installation are simplified when you specify International power for your equipment. International's complete and experienced staff of manufacturer sales representatives, and sales and design engineers supply you with engine dimensional drawings, accurate power curves, and complete specifications. They also help you select the International engine best suited to your particular power, torque, and rpm requirements, and adapt International engines for your tough special applications.

MANUFACTURER

International engineering service can help you cut manufacturing costs, speed up production by showing you the best way to mount International engines in your equipment. Pilot engine models, for your research, production, and testing purposes are also available. In addition, you stand a better chance to sell more of your machines when you offer the buyer International engines as standard or optional equipment. Yes, International engines in the equipment you sell, helps you sell it faster...and helps keep it sold longer.



USER

When you specify International engines you gain the benefits of skill and experience of engine design and manufacture since 1903. In fact, more four-cycle, heavy-duty International diesel engines have been sold since production began in 1933 than any other make. Reasons for this terrific popularity are such inbuilt features as special delivery pressure lubrication through rifle-drilled passages, replaceable cylinder sleeves, and many others.

CHOOSE FROM 17 HEAVY-DUTY INTERNATIONAL DIESEL AND CARBURETED ENGINES—FROM 17 TO 214 HP.

See you at the
ROAD SHOW
CHICAGO
Jan. 28-Feb. 2, 1957

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Company
180 North Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractors and Rubber-Tired Loaders . . . Off-Highway Trucks . . . Diesel and Carbureted Engines . . . Motor Trucks.

The Engineer's Report

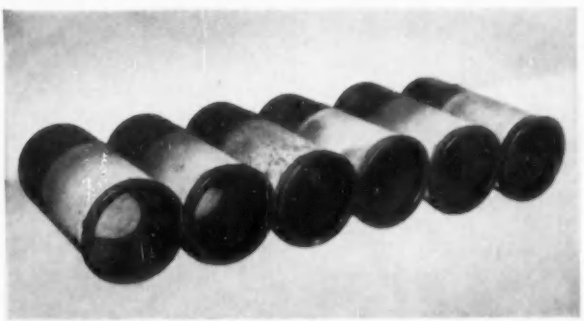
CASE HISTORY

PRODUCT RPM Delo Oils

FIRM E.M. Tharp Trucking Co., Porterville, Calif.

Only 0.0015" sleeve wear in 170,000 miles!

RPM DELO SPECIAL LUBRICATING OIL, and drivers who are trained to avoid practices that shorten engine life, keep maintenance costs to a minimum in the 16 diesel and gasoline rigs owned by E. M. Tharp Trucking Co., Porterville, Calif. Engine in truck above, pulling out with a typical 24-ton load of cottonseed, gives "good as new" performance after 140,000 miles without overhaul. Other engines give similar service in spite of much hauling up 22 miles of constant grade on the Ridge Route to Los Angeles. Sleeves below, shown just as they came from one of the engines after 170,000 miles, have only 0.0015" wear! Owner E. M. Tharp says, "RPM DELO Oils keep our engines cleaner than any oil we've ever used. And bearings stay in such good condition that we often leave them in when we overhaul."

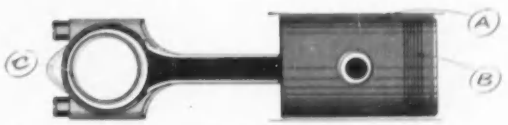


FREE FOLDER tells you about all the RPM DELO Oils and how they meet every heavy-duty engine condition. Write or ask for it today.

FOR MORE INFORMATION about petroleum products of any kind or the name of your nearest distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

How RPM DELO Oils reduce wear, corrosion, oxidation in all heavy-duty engines

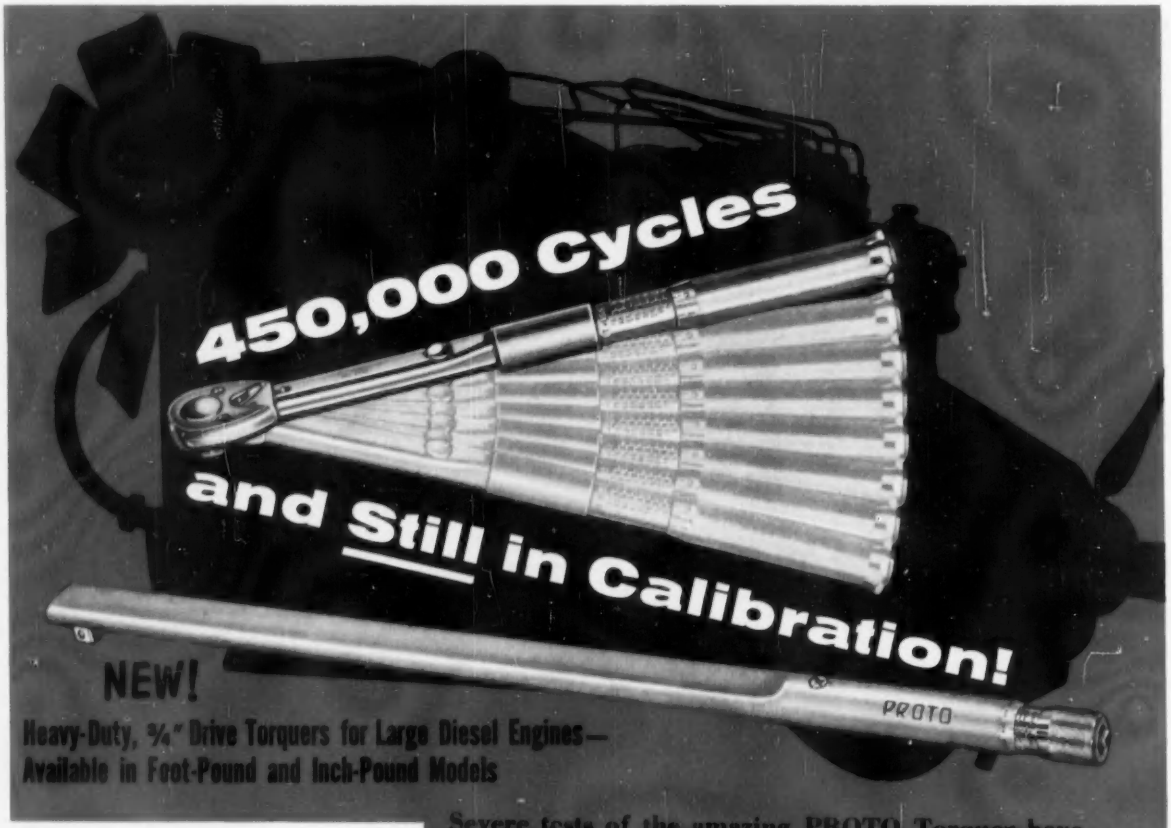


A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado



NEW!

Heavy-Duty, ¾" Drive Torquers for Large Diesel Engines—Available in Foot-Pound and Inch-Pound Models

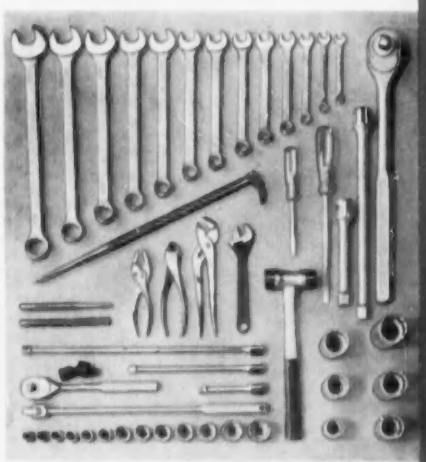
Severe tests of the amazing PROTO Torquer have resulted in its approval and widespread use by many manufacturers and users of diesel engines. A large producer of diesel engines subjected a Torquer to 450,000 torquing cycles and found the tool still in calibration within specified tolerances! A diesel locomotive company, after exhaustive tests, added PROTO Torquers to its railroad catalog. Reasons for the Torquer's acceptance by railroads, other diesel users and manufacturers are many. They like its *automatic* release, great speed (fastest in the World), accurate micrometer-type adjustment, rugged trouble-free design, and absence of pointers, dials and other "gadgets." Besides ¾" drive, heavy-duty "giants," the line includes models in ½", ⅜" and ¼" drives—providing a wide range for diesel work. Ask your PROTO dealer for an on-the-job demonstration of the fabulous Torquer. Send 10c for 68-page catalog showing the entire PROTO line to

PLOMB TOOL COMPANY

2274Z Santa Fe Ave., Los Angeles 54, Calif.

ALSO NEW!

No. 9940 Set for Diesel Maintenance



In one carefully selected professional quality set you get 51 of the most necessary tools for diesel engine maintenance. The set includes end wrenches, an adjustable wrench, socket wrenches and attachments in two drive sizes, pliers, screwdrivers, a bar, a soft-faced hammer, a punch and a chisel.

PROTO® TOOLS

PROTO means PROfessional TOols

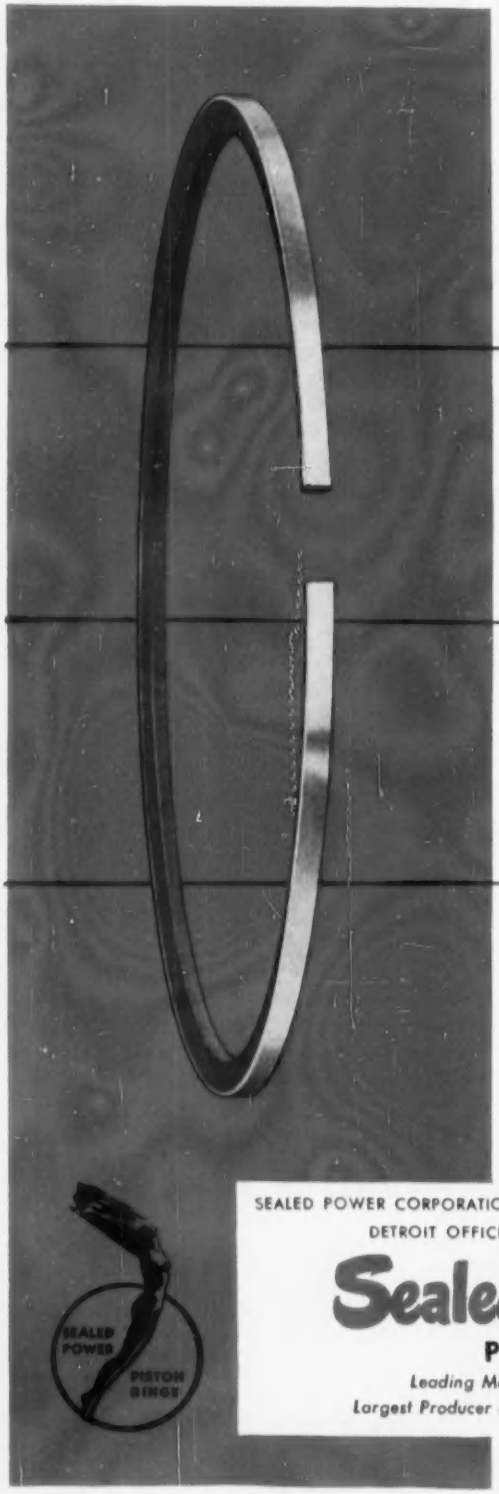
Eastern Factory—Jamestown, N.Y.
Canadian Factory—London, Ont.

Start Training Now

Our lead article spells out the far-reaching aspects of the "Highway Act of 1956". But it's not Congressional "aye's" or the scratching of the President's pen that moves dirt, builds bridge abutments, or lays paving; it's men and machines. To meet annual targets, many more of both will be needed. Full machine utilization during construction seasons will call for some pretty sharp maintenance. Surveys show that the expanding requirements for parts, tools and supplies can be met as the program gets into high blower. But what about all the skilled men needed to keep this machinery running? By "skill" we do not mean simply manual dexterity and familiarization with tools. Given time, you could probably impart these to an ape. The vital ingredient is "know-how". It is the background, experience and specific knowledge of how things work and why that is needed to diagnose troubles, plan the work and execute it intelligently. Training is the key to expanding the work force. And management can make no cheaper investment than to take advantage of every school available. Most engine builders and suppliers of major system components have schools available for users. Some of them are mobile and will come right to your area. Help and encourage men to attend and their learning capacity and interest will gratify you. An example of the desire for technical improvement is the incorporation of the Society of Diesel Maintenance Engineers, initiated by the Diesel Department, Nebraska State Trade School, Milford, Neb. Its objective is to provide technical self-improvement for men employed in the diesel field. The first Chapter's membership comes from the ranks of employers, foremen, mechanics and factory service personnel with interests spread from heavy equipment down to light agricultural equipment. Attendance at monthly meetings averages 75-80, enough to attract top factory service personnel as instructors. Here's another idea to help in training the expanding work force. Start a Chapter in your area and see it pay off.

B P E

SEALED POWER CYCLAN



overcomes 3 main causes of ring failure in Diesel engines!

HEAT

Cyclan retains tension under high operating temperatures.

BREAKAGE

Cyclan will not break in service.

EXCESSIVE SIDE WEAR

Cyclan's excellent bearing qualities prevent excessive groove wear often encountered with cast iron and steel.

WRITE US FOR FURTHER PARTICULARS

SEALED POWER CORPORATION • MUSKEGON, MICHIGAN • ST. JOHN'S, MICHIGAN • ROCHESTER, INDIANA
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Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings since 1911
Largest Producer of Sealing Rings for Automatic Transmissions and Power Steering Units

highlights

Propulsion Research Lab has been opened by Ford in Dearborn to study free-piston engines.

The 2,000,000th Fuel Injection System manufactured by Robert Bosch GmbH left the assembly line of the company's main plant in Stuttgart, Germany.

Mack Truck Volume for the first half of 1956 showed a gain of 51% over the same period in 1955. This is a higher volume than any comparable period in Mack's history, and the trend is the same throughout the diesel industry.

Graduates still keep learning. Representatives from industry, and Canadian and American universities will meet in London, Ontario to discuss the continuing education of the graduate engineer.

Diesel-powered trucks are more common. In 1955, the total of diesel-engined trucks in the 19,500-lb and over GVW class was 900% over the number on the road in 1947. Conversely, gasoline engined vehicles in the same class showed only a 90% rise.

Looks like the diesel is coming into its own.

Automotive Fuel Injection Licensing Agreement to further develop, promote, and subsequently manufacture an automobile fuel injection system was announced by American Bosch Arma and Thompson Products. The two veteran automobile equipment manufacturers will work together in perfecting automotive fuel injection. Under the pact, Thompson will manufacture and market the system.

No Price Increase by Minneapolis-Moline, who are determined to hold the line without an across-the-board increase in prices of their farm machinery, despite rising costs. It will be necessary, however, to increase by 7% prices for repair parts.

Driver Education in the nation's schools has been aided by a $460,000 contribution by GM during the 1955-56 school year. Under its assistance plan, GM awards auto dealers $125 for each new automobile loaned to schools for driver training.

Farm Dieselization Continues. Today there are nearly 12 million motor vehicles and tractors on American farms, almost twice as many as in 1940. Increasingly more are diesel powered.

Because of this liberal mechanization, output per man-hour has jumped 88%.

France does more with less. Today, 8,730 locomotives handle heavier traffic than 20,000 locomotives handled in 1929. In the French National Railroad's annual report for 1955, electrification and dieselization are credited with making great economies possible in both material and personnel.

X-ray movies of a running engine have been made by a General Electric-Detroit Arsenal engineering team. It involved taking x-ray pictures of internal engine movements through its steel housing, and visually stopping action with the aid of a betatron. For the first time, engineers saw faulty performance and wear as it was being done, rather than afterwards through results.

GE says that the machine should have quite an effect on design.

You and the New Highway Program

Facts and figures aimed at helping you gear up to take advantage of opportunities afforded to wide segments of our industry by the "Highway Act of 1956". All levels from engine builders, through suppliers, down to maintenance personnel will be affected.

WHEN President Eisenhower signed the "Highway Act of 1956", he started a chain reaction. The first result of the "Federal Dollar Bullet" that triggered the reaction is the assurance that we are going to get a lot of badly-needed roads. Successive generations of the chain reaction will keep multiplying the effect until it is felt in every single part of the huge segment of industry required to support a major roadbuilding program.

It's a big program and one planned with sufficient continuity to give it long-range stability, a factor necessary to encourage the expansion necessary in the roadbuilding industry. This in turn spreads the chain reaction down to the suppliers of this industry. And a major supplier is the diesel industry. So we can expect an accelerated demand for diesels to power all types of construction equipment and machinery.

The next reaction produced by more diesels, working harder, will be an increased demand for parts, fuels and lubes, supplies. There will be more facilities and tools needed for maintenance and, of course, more men needed to operate and maintain the equipment.

This is perhaps an oversimplified tracing of one path of our chain reaction but the logic is inescapable. Now let's examine some of the details to see how great the impact will be. We can start with . . .

Highlights of "The Highway Act of 1956"

The new law's primary concern is with the completion of the National System of Interstate and Defense Highways. This is to be phased over 13 years. Some 40,000 miles of highway are to be built at an estimated cost of $27-billion. Of this sum the Federal Government will contribute $24.825-billion. States will put in the balance on a 90-10 matching formula, with the government putting up as high as 95% in public lands States. An additional $175-million is available for 1957 construction as authorized by "The Highway Act of 1954". Though this highway system comprises only 1½% of the nation's total mileage it will carry up to 35% of the total traffic.

The regular Federal-Aid Systems—primary, secondary and urban roads—also get a lift. This is a 3-year program for 1957, 1958 and 1959. Funds authorized are $125-million, $850-million and $875-million, respectively. Funds for 1957 are boosted to $825-million since $700-million was authorized in the "Highway Act of 1954".

Funds are also provided for Public Domain Roads and for an Emergency Fund for repairs of Federal-Aid highways damaged by disasters.

All this adds up to a big chunk of money. And the bulk of it is spread over a 13-year period. Why 13 years? We need the roads now. The answer is simply that legislation in itself does not build roads; it takes men, materials and machinery. Today's roadbuilding industry has a certain annual "work-in-place" potential. Beyond this capacity, legislation authorizing excessive funds is meaningless; time for industry expansion is the only answer. So you start by . . . .

Estimating Work Capacities

Probably the most comprehensive job in analyzing the roadbuilding industry's work potential, both current and with realistic, phased expansion, was undertaken by the American Road Builder's Association, Washington, D. C. Being representative of all segments of the highway construction industry, they were in a good position to estimate their industry's current and ultimate work potential and so aid government planners in setting realistic program targets.

President Eisenhower's Advisory Committee on a National Highway Program, headed by General Lucius D. Clay, envisioned a 10-year, $101-billion program. The ARBA was asked to assist in determining the feasibility of sustaining such an undertaking. ARBA went to work (actually they had anticipated the need) to complete an appraisal. Four task forces were appointed to study different phases of the problem as follows:

Task Force No. 1—Planning and Design
Task Force No. 2—Materials and Supplies
Task Force No. 3—Construction
Task Force No. 4—Construction Machinery & Equip.

Conclusions published in a 1955 report stated that the industry was "fully capable of undertaking and satisfactorily executing a 10-year, $101-billion highway program". All this was part of the ground work culminating in the final passage of the legislation.

Some findings of Task Forces Nos. 3 and 4 are of particular interest here in plotting the trend of things to come. This data should be helpful to our industry, right down to the man in the field, for pre-planning to absorb the impact.

As a first step, here are some figures on the . . . .

Current Status of Highway Contractors

Some 5000 contractors reported that they worked at 49% of their estimated capacity in 1955, a 2.6% increase over 1954. This represented contracted highway construction totalling $3.6-billion. They estimated that with then-present organizations and equipment, both owned and rented, about $7.3-billion worth of highway contruction contracts could be undertaken in 1956. Adding force account construction and right-of-way engineering costs would add about $1.5-billion for a total of $8.8-billion.

The 10-year, $101-billion program as then conceived, with the "1954 Inventory of Equipment for Highway Construction", was the basis for the compilation of Table 1 by Task Force No. 4. Major equipment items, the bulk normally diesel-powered, are shown with estimated life factors that were used to determine estimated replacement rates. Annual production rates, balanced against the needs of non-highway claimants, showed the feasability of the proposed rate of industry expansion with respect to equipment.

As basic concepts changed and additional information developed, some changes were inevitable. A new inventory of equipment and machinery available for highway construction as of January 1, 1956 was developed (Table 2). With some question as to the length of the program, a different yardstick for estimating additional equipment needed was developed (Table 3). Correlation with the proposed dollar volume of contract construction would permit ready computation of the equipment needs.

Interstate System funds were authorized in the following manner:

Fiscal Year	*Authorization (billions)*
1957*	1.175
1958	1.700
1959	2.000
1960-1967	2.200
1968	1.500
1969	1.025

**Includes $175-million authorized under "Highway Act of 1954".*

The revised equipment needs reflected some moderating factors of interest. These affected the . . . .

TABLE 1 ESTIMATE OF EQUIPMENT REQUIREMENTS (Major Units) FOR EXPANDED HIGHWAY CONSTRUCTION PROGRAM

DESCRIPTION	1954 Inventory For Highway Purposes Total	1954 Inventory For Highway Purposes Maint.	1954 Inventory For Highway Purposes Const.	Avg. Life, Yrs.	1954 Replacements Maint. & Const.	Replacements Annual Production	1st Year $6.0 Bil. Highway Program Additions	1st Year $6.0 Bil. Highway Program Repls. rets.	1st Year $6.0 Bil. Highway Program Total	2nd Year $10.0 Bil. Highway Program Additions	2nd Year $10.0 Bil. Highway Program Repls. rets.	2nd Year $10.0 Bil. Highway Program Total	3rd Year $11.0 Bil. Highway Program Additions	3rd Year $11.0 Bil. Highway Program Repls. rets.	3rd Year $11.0 Bil. Highway Program Total	4th Year $11.0 Bil. Highway Program Additions	4th Year $11.0 Bil. Highway Program Repls. rets.	4th Year $11.0 Bil. Highway Program Total	5th Year $11.0 Bil. Highway Program Additions	5th Year $11.0 Bil. Highway Program Repls. rets.	5th Year $11.0 Bil. Highway Program Total	6th Year $11.0 Bil. Highway Program Additions	6th Year $11.0 Bil. Highway Program Repls. rets.	6th Year $11.0 Bil. Highway Program Total	7th Year $11.0 Bil. Highway Program Additions	7th Year $11.0 Bil. Highway Program Repls. rets.	7th Year $11.0 Bil. Highway Program Total	8th Year $11.0 Bil. Highway Program Additions	8th Year $11.0 Bil. Highway Program Repls. rets.	8th Year $11.0 Bil. Highway Program Total	9th Year $11.0 Bil. Highway Program Additions	9th Year $11.0 Bil. Highway Program Repls. rets.	9th Year $11.0 Bil. Highway Program Total	10th Year $11.0 Bil. Highway Program Additions	10th Year $11.0 Bil. Highway Program Repls. rets.	10th Year $11.0 Bil. Highway Program Total
CONSTRUCTION MACHINERY AND ALLIED EQUIPMENT																																		
Tractors, Crawler[1]	44,400	12,400	32,000	8	5,550	60,100	4,000	5,550	9,550	8,000	5,550	13,550	7,500	5,550	13,050	3,000	5,550	8,550	5,550	5,550	11,100	5,550	5,550	11,100	5,550	5,550	11,100	5,550	5,550	11,100	5,550	5,550	11,100	5,550	5,550	11,100
*Tractors, 2 & 4 Wheel (Construction Type)	6,600	300	6,300	6	1,100	6,000	2,000	1,100	3,100	4,000	1,100	5,100	3,750	1,100	4,850	1,500	1,100	2,600	1,100	1,100	2,200	1,100	1,100	2,200	1,100	1,100	2,200	1,100	1,100	2,200	1,100	1,100	2,200	1,100	1,100	2,200
Scrapers, Hauling (All Types)	19,050	3,050	16,000	8	2,380	9,750	2,400	2,380	4,780	4,800	2,380	7,180	4,500	2,380	6,880	1,800	2,380	4,180	2,380	2,380	4,760	2,380	2,380	4,760	2,380	2,380	4,760	2,380	2,380	4,760	2,380	2,380	4,760	2,380	2,380	4,760
Off Highway Hauling Equipment (Trucks, Trailers & Wagons)	11,000		11,000	7	1,570	4,700	1,600	1,570	3,170	3,200	1,570	4,770	3,000	1,570	4,570	*1,200	1,570	2,770	1,570	1,570	3,140	1,570	1,570	3,140	1,570	1,570	3,140	1,570	1,570	3,140	1,570	1,570	3,140	1,570	1,570	3,140
Power Cranes & Shovels	20,750	5,750	15,000	10	2,075	13,100	2,800	2,075	4,875	3,600	2,075	5,675	3,350	2,075	5,425	2,100	2,075	4,175	2,075	2,075	4,150	2,075	2,075	4,150	2,075	2,075	4,150	2,075	2,075	4,150	2,075	2,075	4,150	2,075	2,075	4,150
Motor Graders[2]	45,850	20,850	25,000	8	3,730	12,000	2,400	3,730	6,130	4,800	3,730	8,530	4,500	3,730	8,230	2,700	3,730	6,430	3,730	3,730	7,460	3,730	3,730	7,460	3,730	3,730	7,460	3,730	3,730	7,460	3,730	3,730	7,460	3,730	3,730	7,460
Rollers, All Types	19,100	8,100	11,000	10	1,910	12,000	2,000	1,910	3,910	4,000	1,910	5,910	3,750	1,910	5,660	1,500	1,910	3,410	1,910	1,910	3,820	1,910	1,910	3,820	1,910	1,910	3,820	1,910	1,910	3,820	1,910	1,910	3,820	1,910	1,910	3,820
Loaders, Front End, Wheel	5,300	2,300	3,000	6	920	12,000	800	920	1,720	1,600	920	2,520	1,500	920	2,420	600	920	1,520	920	920	1,840	920	920	1,840	920	920	1,840	920	920	1,840	920	920	1,840	920	920	1,840
Ditchers & Trenchers	1,300	100	1,200	8	160	1,500	200	160	360	400	160	560	375	160	535	130	160	310	160	160	320	160	160	320	160	160	320	160	160	320	160	160	320	160	160	320
Hydraulic Hoists and Dump Bodies[3]	(145,000)	(79,300)	(65,700)	6	(24,100)	75,000	(12,800)	(24,100)	(36,900)	(35,600)	(24,100)	(49,700)	(24,000)	(24,100)	(48,100)	(19,600)	(24,100)	(32,700)	(24,100)	(24,100)	(48,200)	(24,100)	(24,100)	(48,200)	(24,100)	(24,100)	(48,200)	(24,100)	(24,100)	(48,200)	(24,100)	(24,100)	(48,200)	(24,100)	(24,100)	(48,200)
Air Compressors, Portable	13,400	4,400	11,000	10	1,340	10,000	1,800	1,340	3,140	3,600	1,340	4,940	3,375	1,340	4,715	1,350	1,340	2,690	1,340	1,340	2,680	1,340	1,340	2,680	1,340	1,340	2,680	1,340	1,340	2,680	1,340	1,340	2,680	1,340	1,340	2,680
Batching Plants, Concrete	4,500		4,500	10	450	500	160	450	610	320	450	770	300	450	750	170	450	620	450	450	900	450	450	900	450	450	900	450	450	900	450	450	900	450	450	900
Concrete Mixers, Portable	8,400	3,000	5,400	8	1,050	10,000	960	1,050	2,010	1,920	1,050	2,970	1,800	1,050	2,850	720	1,050	1,770	1,050	1,050	2,100	1,050	1,050	2,100	1,050	1,050	2,100	1,050	1,050	2,100	1,050	1,050	2,100	1,050	1,050	2,100
Construction Pumps	52,000	13,500	38,500	7	7,430	35,000	1,920	7,430	9,350	3,240	7,430	10,670	7,125	7,430	14,555	1,400	7,430	8,830	7,430	7,430	14,860	7,430	7,430	14,860	7,430	7,430	14,860	7,430	7,430	14,860	7,430	7,430	14,860	7,430	7,430	14,860
Concrete Pavers	1,470		1,470	10	150	150	320	150	470	320	150	470	330	150	480	90	150	240	150	150	300	150	150	300	150	150	300	150	150	300	150	150	300	150	150	300
Concrete Spreaders	1,470		1,470	10	150	150	320	150	470	320	150	470	330	150	480	90	150	240	150	150	300	150	150	300	150	150	300	150	150	300	150	150	300	150	150	300
Tank Wagons & Agitators	8,300	200	8,100	5	1,660	6,000	1,200	1,660	2,860	2,400	1,660	4,060	2,250	1,660	3,910	900	1,660	2,560	1,660	1,660	3,320	1,660	1,660	3,320	1,660	1,660	3,320	1,660	1,660	3,320	1,660	1,660	3,320	1,660	1,660	3,320
Asphalt plants, Bituminous Pavers (Spreaders—Finishers)	2,250	250	2,000	10	225	400	200	225	425	400	225	625	375	225	600	150	225	375	225	225	450	225	225	450	225	225	450	225	225	450	225	225	450	225	225	450
Bituminous Distributors	3,150	150	3,000	10	315	400	320	315	635	640	315	955	600	315	915	340	315	655	315	315	630	315	315	630	315	315	630	315	315	630	315	315	630	315	315	630
Crushing & Screening Plants	7,700	1,000	6,700	10	770	1,100	200	770	970	400	770	1,170	375	770	1,145	150	770	920	770	770	1,540	770	770	1,540	770	770	1,540	770	770	1,540	770	770	1,540	770	770	1,540
Miscellaneous Units (10%)	4,000	1,700	2,300	10	400	500	280	400	680	560	400	960	525	400	925	210	400	610	400	400	800	400	400	800	400	400	800	400	400	800	400	400	800	400	400	800
	38,237	8,775	19,332		3,545		2,337	3,545	6,132	5,114	3,545	8,659	4,793	3,545	8,339	1,918	3,545	5,462	3,545	3,695	4,535	4,717	6,099	4,398
SUBTOTAL	311,597	96,313	215,072		38,990		28,127	38,990	67,117	36,254	38,990	93,244	52,743	38,990	91,733	21,093	38,990	60,083	38,990	40,440	43,480	31,882	67,084	70,373
MOTOR VEHICLES																																		
Pickups & Autos	26,710	25,960	10,750	4	9,180		2,080	9,180	11,260	4,160	9,180	13,340	3,900	9,180	13,080	1,360	9,180	10,740	11,780	13,340	13,080	10,740	11,780	13,340
Trucks, 1½-3 Tons	99,000	60,500	38,500	5	19,800		7,680	19,800	27,480	15,360	19,800	35,160	14,400	19,800	34,200	5,760	19,800	25,560	29,400	35,160	34,200	25,560	29,400	35,160	34,200	25,560	29,400	35,160	34,200	25,560	29,400	35,160	34,200	25,560	29,400
Trucks, Over 3 Tons	67,200	32,000	35,200	6	11,370		6,800	11,370	18,600	13,600	11,370	24,970	12,750	11,370	24,120	5,100	11,370	16,470	11,370	11,370	22,740	11,370	19,870	31,240	11,370	19,870	31,240	11,370	19,870	31,240	11,370	19,870	31,240	11,370	19,870	31,240
Trucks, Miscellaneous	5,050	1,100	3,950	6	840		1,440	840	2,280	2,880	840	3,720	2,700	840	3,540	1,080	840	1,920	840	840	1,680	2,640	3,770	6,410	2,640	3,770	6,410	2,640	3,770	6,410	2,640	3,770	6,410	2,640	3,770	6,410
SUBTOTAL	207,960	119,560	88,400		41,190		18,000	41,190	59,190	36,000	41,190	77,190	33,750	41,190	74,940[4]	13,300	41,190	54,690	43,790	54,950	70,750	72,630	65,000	51,530
GRAND TOTAL	519,557	216,085	303,472		80,180		46,127	80,180	126,307	92,254	80,180	172,434	86,493	80,180	166,673	34,393	80,180	114,773	82,780	95,390	114,230	104,512	132,084	121,903

Notes:
[1] Estimate of tonnage use and life of equipment for public highway departments and contractors.
[2] Excluding motor patrols.
[3] Excluding dump trucks, concrete mixers, contract construction volume amounts to $4.8 billion, an increase of $1.3 billion over 1954 level.
[4] Including attachments and power control units.

[1] Including Power Maintainers.
[2] Stabilized figures (1) not in totals, included as integral part of Trucks and Off Highway Hauling Equipment.

Equipment Available for Highway Contract Construction as of January 1, 1956

Description	No. Units
Construction Machinery and Allied Equipment	
Tractors, Crawler(1)	33,000
Tractors, 2 and 4 Wheel (Contractors Type)	9,300
Scrapers, Hauling (All Types)	17,200
Off-highway Hauling Equipment (End, Side and Bottom Dumps)	11,200
Power Cranes & Shovels	16,500
Motor Graders	15,100
Rollers, All Types	13,000
Loaders, Front End, Wheel	6,500
Ditchers & Trenchers	1,210
Hydraulic Hoists & Dump Bodies(2)	(70,000)
Air Compressors, Portable	13,750
Batching Plants, Concrete	4,000
Concrete Mixers, Portable	5,200
Contractor Pumps	41,500
Concrete Pavers	1,125
Concrete Spreaders	1,525
Concrete Finishers	1,525
Truck Mixers & Agitators	7,300
Asphalt Plants, Portable	2,000
Bituminous Pavers (Spreaders-Finishers)	3,040
Bituminous Distributors, Truck Mounted	6,500
Crushing & Screening Plants, Portable	2,300
Miscellaneous Units (10%)	20,928
Subtotal	**233,703**
Motor Vehicles	
Pickups & Autos	11,825
Trucks, 1½ - 3 Tons	42,350
Trucks, over 3 Tons	38,720
Trucks, Miscellaneous	4,050
Subtotal	**96,945**
Grand Total	**330,648**

(1)Including attachments and power control units.
(2)Not in total, included as integral parts of trucks and off-highway hauling equipment.

Table 2. Inventory of civil construction equipment.

Additional Equipment Required for $1.0 Billion of Net Highway Contract Construction

(For annual work volumes in excess of $5.8 billion)

Description	No. Units
Construction Machinery and Allied Equipment	
Tractors, Crawler(1)	4,500
Tractors, 2 and 4 Wheel (Contractors Type)	3,000
Scrapers, Hauling (All Types)	3,200
Off-highway Hauling Equipment (End, Side and Bottom Dumps)	1,800
Power Cranes & Shovels	3,000
Motor Graders	2,500
Rollers, All Types	2,500
Loaders, Front End, Wheel	1,600
Ditchers & Trenchers	250
Hydraulic Hoists & Dump Bodies(2)	(16,000)
Air Compressors, Portable	2,250
Batching Plants, Concrete	300
Concrete Mixers, Portable	1,200
Contractors Pumps	2,340
Concrete Pavers	150
Concrete Spreaders	175
Concrete Finishers	175
Truck Mixers & Agitators	1,500
Asphalt Plants, Portable	200
Bituminous Pavers (Spreaders-Finishers)	300
Bituminous Distributors, Truck Mounted	250
Crushing & Screening Plants, Portable	250
Miscellaneous Units (10%)	3,144
Subtotal	**34,584**
Motor Vehicles	
Pickups & Autos	2,600
Trucks, 1½-3 Tons	9,600
Trucks, over 3 Tons	8,500
Trucks, Miscellaneous	1,800
Subtotal	**22,500**
Grand Total	**57,084**

(1)Including attachments and power control units.
(2)Not in total, included as integral parts of trucks and off-highway hauling equipment.

Table 3 (right). Necessary additions per $1-billion of work.

Size and Work Potentials of Equipment Aggregations

Trends in modern equipment design are bound to affect the number of units required per $1-billion of construction. Task Force No. 4 cites several factors—higher horsepowers, self-propelling features, increasing application of torque converters, improvements in pneumatic tires, etc.—that increase unit productivity. Going into 1956, the percentage of new equipment, continually augmented by improved replacement units, will reduce the required total needed for a given amount of work.

On the other hand, the $7.3-billion contract highway construction that the contractors thought that they could sustain in 1956 was deemed optimistic. Their figure was a straight-line projection based on 100% utilization of all equipment. In view of the size and dispersion of most work projects, the competitive bidding system, certain duplication of equipment, etc., the actual percentage of utilization attained would be somewhat lower.

The equipment listed in Table 2 included that owned by highway contractors, by equipment distributors and by key material producers. With all engaged in construction similar in type to that put in place in 1955, it was estimated that the contract highway work that could be put in place in 1956 would be about $5.4-billion, or about $1.5-billion less than the contractors' estimate. This was still another factor used to "weight" the estimate of equipment requirements for an expanded highway program.

Now all this equipment costs money and in order to see what this huge program means in equipment dollars it is necessary to know the . . . .

Ratio of Construction Cost to Equipment Costs

Contractors also reported on the amounts of different classes of work put in place per dollar of equipment investment. For all classes, an average equipment dollar produced $4.50 worth of construction in one year. This and the following ratios are based on full, *not average*, utilization. By work classes, annual dollar volumes per equipment dollar are:

Earthmoving —$2.67 *of work*
Surfacing —$5.42
Structures —$7.10
Other —$6.10

Actually, the value (new) of the equipment engaged in

contract highway construction represented 47% of the $3.6-billion worth of work. Plus the contractors equipment, there is the segment of equipment owned by key suppliers—aggregate producers, asphalt industries, ready-mix concrete producers, etc. This represents about 9% of the work value annually put in place and brings the total equipment replacement value to 56% of the work value.

However, after "weighting" the data assembled, Task Force No. 4 figured a new-equipment value of 52% of the annual highway construction to be placed. So as a pretty good estimate, for each billion dollars of construction, $520-million will be tied up in equipment, each year a good part of it new.

Now that it's possible to get an idea of the new equipment involved, let's dig into the matter of . . . .

Keeping Them Running

Equipment manufacturers and engine builders have all developed their own figures on average parts requirements per year per unit. Users have similarly developed usage factors.

The trend toward a higher utilization factor was found even prior and perhaps in anticipation of passage of the 1956 legislation. The 1954 survey of contractors showed a utilization factor of 46.4% and the figure went up to 49% in 1955. With the expansion of the program it will go still higher, in peak periods approaching about 80%.

Some basis for projection of the increased demand for repair parts can be taken from another 1954 survey. In that year ARBA held a "Symposium on Road Equipment" in which H. A. Radzikowski, Chief, Maintenance Branch, Bureau of Public Roads participated. He submitted Table 4 as part of his presentation.

Note that the table refers to highway maintenance equipment and not that engaged in construction. Still, it gives a basis for estimation since many of the items are the same as used in both services and do essentially the same jobs. Adjustments in the "Annual Use" column and in replacement percentages can be made on the basis of individual experience.

Another clue as to the estimated increase in equipment utilization is found in an ARBA table listing estimated material requirements covering 1955, 1956 and the 13-yr program starting in 1957. The line item referred to is "Petroleum Products" which includes gasoline, diesel oil, lubricating oil, grease, etc.

It has frequently been suggested that fuel usage is a better index for setting up maintenance periods than either operating time or mileage. The shape of the fuel consumption curve tends to compensate automatically for idling time and high-load periods, both harder than normal service. So the increase in fuel usage is a fair indication of how much harder and longer the equipment is working.

Although fuel is only a part of the total "Petroleum Products" category, the relationship between the amounts of fuel to lube, greases, etc., remains reasonably constant.

REPAIR PARTS REQUIREMENTS
FOR HIGHWAY MAINTENANCE EQUIPMENT
(Expressed in percentages of original equipment cost)

Description	Average Annual Use	% Part Replacements Per Annum	Per 10,000 mi	Per 1,000 hrs
MOTOR VEHICLES				
Automobiles	16,000 mi.	9.5	5.9	
Personnels	11,000	7.7	7.0	
Pickups	12,000	7.1	5.9	
Trucks 1½-2 Ton	13,000	10.4	8.0	
Trucks over 2 Ton	9,000	5.7	6.3	
MACHINERY				
Air Compressor	500 hrs.	4.5		9.0
Core Drill	600	4.3		7.2
Cranes Tr. Mounted	400	6.6		16.5
Crushing-Screening Plants	1,000	12.0		12.9
Distributors	600	5.7		9.5
Graders, Motor	1,500	8.5		5.7
Graders, Pull	200	3.1		15.5
Loaders, Forced Feed	600	10.1		16.8
Loaders, Scoop	500	9.0		18.0
Maintainers, Self-Propelled	900	8.2		9.1
Mixers, Concrete	200	4.4		22.0
Mixer-Paver Stabilizing	600	4.1		6.8
Mower, Tractor	400	12.2		30.5
Pavement Breaker	300	3.2		10.7
Paver, Bituminous	300	5.1		17.0
Rollers, Road	300	4.3		14.3
Shovels, Power	1,000	7.6		7.6
Snow Plows, one-way	100	4.6		46.0
Snow Plows, Rotary	500	7.7		15.4
Snow Plows, V	100	3.5		35.0
Tractors, Crawler	700	9.8		14.0
Tractors, Wheel	500	8.6		17.2
Trailers, Platform	500	5.7		11.4

Table 4. Estimated parts requirements. See text for comments.

Thus, the percentage increases in total petroleum products apply with reasonable accuracy to the increases in fuel used. Of course, adjustment must be made in the "phasing-in" period (1957-1960) and "phasing-out" period to allow for the change in the number of units in use.

Estimated demand for petroleum products in millions of gallons with 1955 figures as a base year are:

1955	652
1956	744
1957	908
1958	987
1959	1029
1960-1967	1059
1968	971
1969	913

Conclusion

Attempt has been made to provide some basic data as a bench mark from which various segments of the diesel industry can lay out their own lines. There can be no absolutes; at this point everything has to be educated guesses. It will be necessary to modify assumptions in terms of experience and fields of interest.

One thing is clear: It is a huge program and the chain reaction will reach down to all segments of the diesel industry and its suppliers. With the expanded diesel usage, there will be corresponding increases in the whole supporting structure that keeps these engines running. Parts, supplies, facilities, tooling and men to use and apply them will be in increased demand.

You don't expand overnight; it takes planning. That's why we bring you this data, aimed at helping you to get ready and take advantage of the opportunities afforded by this huge national program.

This FTD Euclid, 15-yd bottom-dump has just had its Cummins, 6-cyl, 200-hp, model NH-1 diesel engine installed after it was rebuilt at the field shop. The final touches are being given to it by Lee Mack, the shop foreman, and a mechanic, before it is started, and run-in for several hours.

Keeping Road Building Equipment Working

By Joseph S. Cascio—Special Assistant to Editor

Here's how George Brewster & Son, Inc., plans and executes maintenance—from preventive maintenance to supporting shops—to keep a multi-million dollar Pennsylvania Turnpike project moving on schedule.

MAINTENANCE practices on diesel equipment used by road-building contractors are different from those followed in other applications. For example, bus and truck fleets, power plants, railroads, etc., have scheduled maintenance and engine rebuilding periods determined by mileage or hours of operation. And they can stick to it. But you can't do this with construction equipment, according to Mr. H. F. Freet, Equipment Superintendent, of G. M. Brewster & Son, Inc., one of the largest construction contractors in the United States.

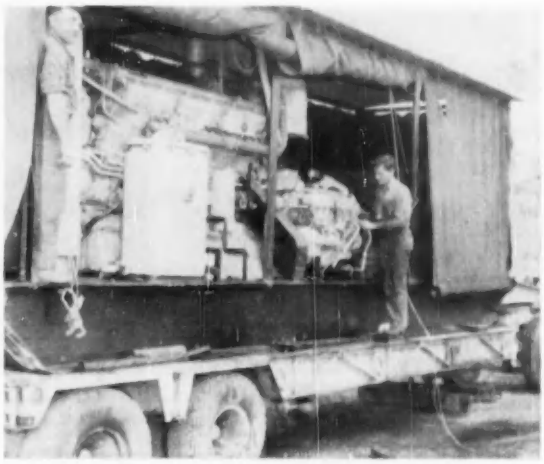
Deadlines are set, within which time construction jobs must be finished. Contractors may even be penalized if they fail to meet the schedule through their own fault. Therefore, the equipment must be, and generally is kept working until it can't do its job properly any longer. But that is only part of the problem.

These large pieces of equipment, such as shovels, scrapers, tractors, bulldozers, etc., can't possibly be sent to the contractor's main repair shop at Bogota, N. J. for minor adjustments or repairs. The job site may be hundreds of miles away. Sometimes these units can't even be spared for a trip to a field shop which may be only several miles away. This means then, that mobile maintenance crews must be available to make minor adjustments and repairs right on the job site.

If the unit can't be repaired or adjusted in the field, it may be taken to the field shop. If it can be spared, it may be sent to the main shop. Sometimes the unit is urgently needed. In this case a rebuilt engine may be rushed from the main shop and installed in the field, or the damaged engine may be completely rebuilt quickly at the field shop. If a spare piece of equipment is available from the main shop it may be used to replace the one that's out of order.

Let us discuss in detail exactly what is done at the job site, in the field shop and in the main shop of a road-building contractor — and how it is done. But first let's look at a little of the background of one specific job — the one we're talking about.

After being installed and idled for several hours, the newly rebuilt Cummins NH-1 in this 18-yd Euclid rear-dump truck is having its cylinder head re-torqued. It will then be given a field test.



One of Brewster's Bucyrus electric shovels is powered by this trailer-mounted 325-kva, 2400-v, generator which is driven by a Caterpillar, D397 12-cyl, vee-type diesel just being started.

Background

The newest link in the Pennsylvania Turnpike system, extending 110 miles from historic Valley Forge, Pa. to Clark's Summit, Pa., has been and is being built in sections. This is part of the widely publicized national road building program. In Nov. 1955, Brewster started to work on about a seven-mile section of the turnpike, centered around Taylor, Pa., a few miles from Scranton, Pa. This section is scheduled for completion late next spring.

It's a tough assignment because most of the road has to be cut through rock in a mountain and built over coal strippings which have to be filled and rolled to get a solid base and avoid settling. This being a great coal region, tons of coal also had to be removed to prevent fires under the road bed later on.

To do this job, as many as 170 pieces of equipment were used at one time on this seven-mile stretch. Thus the need for an extensive maintenance program.

Here's some of the construction equipment working on this project. Several Bucyrus-Erie, 5-yd, electric shovels are used. These are powered by trailer-mounted, diesel-driven generators. Each generator is rated 325-kva, 2400-v and is driven by a 12-cyl, vee-type, Caterpillar diesel. Other Bucyrus-Erie shovels, of 2½-yd capacity, are powered by Buda diesels.

The bulldozers used, are powered by Caterpillars and by Detroit Diesels (GM). GM 6-71's and Cummins diesels are used on the Euclid scrapers. Other scrapers have Caterpillar engines and so do the graders. The compactor rollers are powered by Cat diesels.

Large drill rigs, and air compressors are driven by GM 71's. Euclid 22-ton rear-dump trucks, and Euclid 18-yd bottom-dump trucks are powered by Cummins and GM 71 diesels.

To service and repair these units, nine mobile mainte-

A transmission adjustment is being made on this big Cat D9 right at the job site. This bulldozer is powered by a 6-cyl, turbo-charged diesel engine rated 230-hp (drawbar) and 286-hp at flywheel.

Another example of the repairs that can be made at the job site is the replacing of a rear spring on this Cummins-powered 25-yd, rear-dump truck. It has twin 6-cyl, Cummins diesels rated 200-hp each.

One of four lubrication trucks, each staffed by three men. Each truck is equipped with lube oil tanks and pumps; grease guns; air compressor; emergency fuel; and gasoline engine-driven generator.

One of nine mobile maintenance trucks, each having a 2-way radio; tool kit; small welding unit; engine parts frequently used; assorted nuts and bolts; cable; fire extinguisher; and a mechanic.

One of two tire trucks covering construction area. Hoist is used to lift end of trucks for changing tires, also for lifting engines and other heavy parts from equipment. Truck also has air compressor.

One of two portable welding units which travel to the job site to repair broken equipment which cannot be taken to the field shop because it can't be spared or because it's too large to carry.

nance trucks, four lubrication trucks, two fuel trucks, and two portable welding outfits cover the actual construction area continuously. Let's see how each of these units is equipped and what it does on the road.

Mobile Maintenance Crews

Each of the mobile maintenance trucks is equipped with a 2-way radio; one mechanic; the mechanic's own tool kit; small welding unit; cable; small engine parts frequently used; assorted nuts and bolts; and a fire extinguisher.

Each mechanic, with the equipment available on his truck, is capable of making many minor adjustments and repairs. For example, here are some of the things he can do. If he suspects a nozzle is faulty, he can check the spray (on certain types) by removing it from the cylinder, reconnecting it to the injection pump and working the pump manually. The nozzle then sprays in the open. If the spray pattern or angle isn't satisfactory, or orifices are clogged, the nozzle is replaced.

Other faulty parts which he can replace are injection pumps, fuel transfer pumps, starters, generators, batteries and any other external engine parts. He can also prime fuel systems, correct injection timing, set valve clearances, fix fuel and lube oil leaks, etc. Minor repairs can also be made by these crews on tractor cables and tracks, steering mechanism, brakes, clutches, rollers, etc.

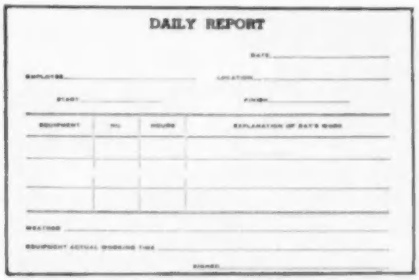
Mobile maintenance crews work over a specified area and travel back and forth between two points a few miles apart. They're assigned to jobs in several ways. They get calls by radio from Jim Boyan, dispatcher, at the field shop, or from a work area superintendent who also has a radio in a shack. The crews also get calls from operators of equipment as they pass by on the road between jobs.

If the mechanic on the truck needs help, or instructions and data on engines, he calls the field shop office by radio and talks to Lee Mack, the very capable shop foreman. If more mechanics are needed at the job site, they're sent out from the field shop.

When the mechanic finds that he can't repair the engine at the site, or he thinks that it needs to be completely rebuilt, the equipment is taken to the field shop if it can be spared. If not, the engine is removed on the site and replaced with one from the main shop at Bogota. The removed engine is then sent to the Bogota shop or rebuilt in the field shop, depending on how soon it's needed.

The mobile maintenance crews are not responsible for the lubrication of the units in the field. This is handled by the four lubrication trucks, each staffed with three men. Each truck is equipped with lube oil tanks with pumps; grease guns; air compressor; some fuel for emergency use; and a gasoline engine-driven generator set for powering a bank of lights at night.

The men on these trucks add lube oil to the engine when necessary; change lube oil, fuel and lube oil filters; grease equipment; check transmissions; and winterize engines and equipment. They check the cooling system once a week after winterizing and add antifreeze if necessary. Rust inhibitors are always put in after each cooling system water-change.



DAILY REPORT

DATE

EMPLOYEE LOCATION

START FINISH

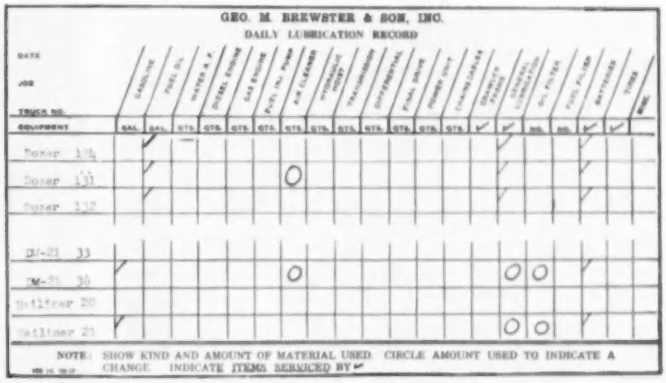
EQUIPMENT	NO.	HOURS	EXPLANATION OF DAY'S WORK

WEATHER

EQUIPMENT ACTUAL WORKING TIME

SIGNED

Above is the daily report form on which the field mechanics and the field shop men list every adjustment or repair made on the engine in the field or shop. The data on this form is transferred to a permanent record book at the end of each working day.



GEO. M. BREWSTER & SON, INC.

DAILY LUBRICATION RECORD

DATE

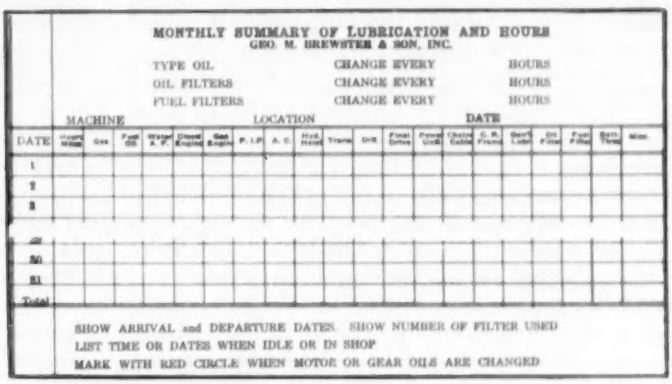
JOB

TRUCK NO.

EQUIPMENT	GASOLINE GAL.	FUEL OIL GAL.	WATER & A.F. QTS.	DIESEL ENGINE QTS.	GAS ENGINE QTS.	FUEL INJ. PUMP QTS.	AIR CLEANER QTS.	HYDRAULIC SYSTEM QTS.	TRANSMISSION QTS.	DIFFERENTIAL QTS.	FINAL DRIVE QTS.	POWER SHIFT QTS.	CHAIN CASES QTS.	GREASE PRESS ✓	GENERAL LUBRICATION ✓	OIL FILTER NO.	FUEL FILTER NO.	BATTERIES ✓	TIRES ✓	MISC.
Dozer 13		✓												✓				✓		
Dozer 17		✓					O							✓				✓		
Dozer 22		✓												✓				✓		
DW-21 33	✓																			
DW-21 36							O							O	O			✓		
Heiliner 20																				
Heiliner 21	✓													O	O			✓		

NOTE: SHOW KIND AND AMOUNT OF MATERIAL USED. CIRCLE AMOUNT USED TO INDICATE A CHANGE. INDICATE ITEMS SERVICED BY ✓

The daily lubrication record form at the upper right is given to the men on the lubrication truck each day. It indicates exactly which bulldozer, etc., is to have it's engine checked to see if lube oil is to be added; or to have it's lube oil or filters changed; or in winter if anti-freeze is needed. All that is done is checked off on the form.



MONTHLY SUMMARY OF LUBRICATION AND HOURS

GEO. M. BREWSTER & SON, INC.

TYPE OIL CHANGE EVERY HOURS

OIL FILTERS CHANGE EVERY HOURS

FUEL FILTERS CHANGE EVERY HOURS

MACHINE LOCATION DATE

DATE	Engine Make	Gas	Fuel Oil	Water & A.F.	Diesel Engine	Gas Engine	P. I.P.	A. C.	Hyd. Hoist	Trans.	Diff.	Final Drive	Power Unit	Chain Cases	G. E. Fittings	Gen'l. Lube	Oil Filter	Fuel Filter	Gen'l. Tires	Misc.
1																				
2																				
3																				
...																				
30																				
31																				
Total																				

SHOW ARRIVAL and DEPARTURE DATES. SHOW NUMBER OF FILTER USED

LIST TIME OR DATES WHEN IDLE OR IN SHOP

MARK WITH RED CIRCLE WHEN MOTOR OR GEAR OILS ARE CHANGED

Data from daily lubrication record is transferred to permanent record sheet at right at the end of each day. The lubrication supervisor checks this form to determine when the lube oil or filters are to be changed on the specific pieces of equipment.

Instructions for checking or changing lube oil and filters on a specific engine are given to the lubrication crew by Bill Oehl, lubrication supervisor. He gets his information from permanent records kept on every engine and piece of equipment. The crew is given a form listing all equipment by number. Those to be serviced are marked to show whether oil or filters are to be changed, or oil to be added, etc.

A record is made on this form of all that's done on the engine or equipment. When this form is turned in to the supervisor at the end of each day, he transfers the data to the permanent record book.

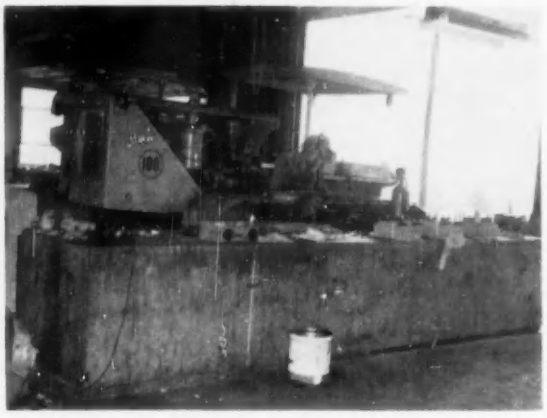
Oil and filter change periods are set according to hours of operation for the different types of equipment. For example, oil is changed on all tractors after the same number of hours of operation regardless of the type of diesel used. The same applies to the scrapers, graders, etc. The time interval for these changes was chosen after experimenting to find the most economical period for the type of work done by the equipment. The oil is kept in as long as possible without having it become so contaminated as to cause undue wear. No effort is made to reclaim this oil, it's discarded.

The following tabulation shows how often the lube oil and filters are changed in the diesel engines.

Equipment	*LO & LO Filter Changed (hours)*	*Fuel Filter Changed (hours)*
Shovels	75	300
D-4 & D-6 bulldozers	120	240
Roller compacters	75	75
Cat generator sets	300	300
D8 & D9 dozers	240	240
Graders	240	240
Euclid scrapers	75	75
Euclid rear & bottom dump trucks	75	300
Heiliners	75	300
DW 21's	120	240
Air compressor engine	100	100
Air compressors	500	none

In addition to the mobile maintenance crews and the lubrication crews, there are two fuel trucks which travel the work area filling the equipment's tanks. Also, two tire trucks cover the area. These are equipped with an air compressor for blowing up tires and a hoist capable of lifting one end of a Euclid to change tires. The hoist is also used to lift engines and other heavy parts from the equipment when necessary.

Bill Lovering is seen receiving call on radio located in small office next to field shop. This call was from a mechanic in field asking for instructions. Shop foreman was called in to answer it



Mechanic is seen replacing valves in cylinder heads which are lined up on long work bench running across center of field shop. Caterpillar diesel powered bulldozer is seen behind the mechanic.

Field Shop

All these mobile crews are controlled from the field shop which is located several miles away from the actual work area. It consists of a corrugated metal shed. In addition to the shop there are two small offices and a parts room. The shop is large enough to accommodate four bulldozers at a time, if necessary. A large area around the outside of the shop can hold 50 or more large pieces of equipment. Weather permitting, this equipment is worked on in the open if the shop is filled with other machines.

Any equipment urgently needed on the job is overhauled and rebuilt in the shop. If it can be spared, it's sent to the Bogota shop. About 75% of all engines replaced on the job are rebuilt at Bogota.

The field shop is equipped to completely rebuild any size diesel on the job as well as the construction equipment itself. Rebuilding of these engines generally consists of replacing pistons, rings, liners, bearings, bushings, valves, injection pumps and nozzles. Crankshafts and camshafts are sent to a local shop or engine distributor's shop if they need regrinding. The same applies to line boring of bearing saddles, con rod alignment and piston pin fitting, and rebuilding of cylinder heads, injections pumps and nozzles.

There is no specific number of hours set on construction work for an engine overhaul or engine replacement. An engine of the same power, size, make and type, even in the same type of construction equipment, may need rebuilding at entirely different times, while working the same number of hours. One may be doing very hard work while the other is doing an easier type of work for the same period of time.

Also, one piece of equipment may be doing one type of work for a certain time and then shifted to another job to do a different kind of work. So, since the same unit isn't doing the same work all the time, no schedule can be set up for rebuilding or replacing engines on, say, all tractors or all shovels, etc. In construction work, then, the time for engine teardown and rebuilding is determined individually and by the specific engine's symptoms.

These symptoms include: excessive lube oil consumption; excessive crankcase blowby, consistent low lube oil pressure; or a major breakdown. When the engines get to the point where these symptoms show up and they must be rebuilt, all liners, pistons, rings, bearings, piston pins and bushings are practically always replaced.

Liners, pistons, rings and piston pins are obtainable as an assembly and no fitting or adjustment of clearances is generally necessary. Bearings are always replaced as a set every time the engine is torn down completely. Valves are used over again, if in good condition and are not burned or broken. They're refaced, ground and reused. Cylinder heads are sent out for servicing. This includes surface grinding of the head and replacing of seat inserts, valve guide, and rocker arm bushings.

If the crankshaft is 0.002 to 0.003-in. out-of-round, it's sent out for regrinding. This also applies to the camshaft if the cam noses are excessively worn. Con rod bushings are also replaced by an outside shop and the pin is sent

Well stocked parts-room is located at one end of field shop. Special tools are obtained from here as well as parts for any of the diesel engines in the field. A record is kept of all parts used.

Five rotary files in shop office in Bogota, hold cards which list every engine part available in the parts-room. Each part has a manufacturer's "parts number" and is ordered by use of this number.

Brewster's large main shop at Bogota, N. J. The equipment superintendent's office is visible at far end of shop. It projects out into the shop and is surrounded by glass giving an excellent view.

with the rod for fitting. At this time, con rod alignment is also checked.

All small parts that are to be reused are soaked and cleaned in Sarvasol or with steam and wire brushed. Large parts, such as the cylinder heads, blocks, etc., are cleaned with steam and wire brushed. This is done right after the engine is torn down, so that when engine is assembled all parts are perfectly clean.

After the engine is reassembled at the field shop, it is installed on the equipment and run-in. It's run at low idle for about four to five hours during which time the engine is checked for leaks and other noticeable defects. Temperatures and pressures are checked constantly. The engine is then stopped, head is re-torqued, valve clearances checked and engine started again.

After this preliminary run-in period, if everything is okay the equipment is given to an operator who is familiar with the way to operate field shop-rebuilt engines. This operator will run the engine at part loads for two or three days before making it operate at full load continuously. And he will watch it carefully, stopping it at the first sign of overheating, oil pressure drop, or if he hears any unusual sounds.

The time required to rebuild a specific engine varies. It depends on how soon the equipment is needed on the job. If an emergency job comes into the shop, work on other engines is stopped until the engine most urgently needed is finished.

Cost records of rebuilding these engines are not kept but a permanent record of everything that is done to the engine is accurately kept on forms. Both the men in the field shop and on the job site write up exactly what is done to the engine on a "Daily Report" form. Data from this form is transferred to a permanent record book each day. A record is also kept of every part used and when the supply of a specific part runs low a certain number are ordered depending on how frequently the part is used. Parts are ordered direct from an outside supplier or engine distributor.

Bogota Repair Shop

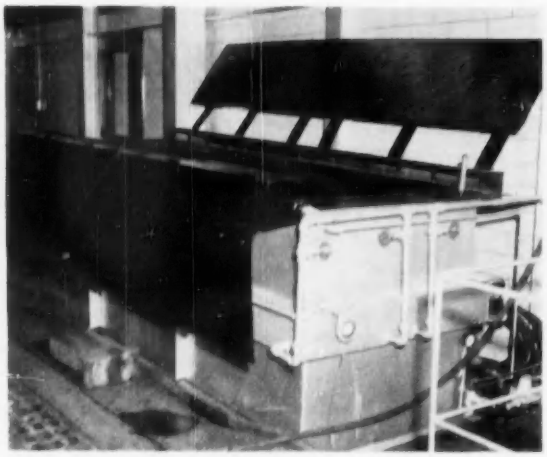
The parts program at the field shop is a miniature of that at the main shop in Bogota. Parts are kept on hand in accordance with the demand. All parts are listed on cards in a rotary file. Each part used is checked off the list. The number remaining is then checked and depending on frequency of use, more are ordered if necessary.

All parts have a "part number" and are ordered by this number, if bought from the engine manufacturer. However, these parts may be bought from other suppliers, if they can be obtained cheaper and are of good quality and have the same guarantee as those of the engine manufacturer. Since the main shop must handle replacement equipment for many other projects, in addition to that at the Pennsylvania Turnpike, a saving in the cost of the numerous parts used is very desirable.

As previously mentioned, by far the greatest majority of engine rebuilding is done at the main shop. Only those engines urgently needed are rebuilt at the field shops, the remainder are sent to the main shop.

When these engines are received at Brewster's main shop, they are completely disassembled and cleaned so that they may be inspected. The cleaning is done in a chemical vapor degreasing tank which is 12-ft long, 8-ft deep and 3-ft wide. It can handle the largest part of a Cat D8 or 9, for example, the block.

A small section through one of the three parts-rooms at the Bogota shop. These parts-rooms are stocked with every part necessary for rebuilding any of Brewster's engines or construction equipment.



This chemical vapor degreasing tank is 12-ft long, 8-ft deep and 3-ft wide. Steam coils at bottom of tank heat trichloroethylene to 182°F. Vapor rises and acts on engine parts suspended in tray.

John Welthan installs valve guides in a cylinder head from a Waukesha 140 HS diesel at the Bogota shop. By using a hydraulic handpump instead of a large hydraulic press he can tell if guides are going in too hard and binding. He also avoids carrying head to press.

Trichloroethylene is the chemical used, 110 gal of which is put into the tank every three weeks. Steam coils at bottom of the tank heat the chemical to 182°F. At this temperature, vapor from the chemical rises and acts on the egine parts in a 7-ft long tray suspended in the tank by a chain hoist. The parts are removed after about 10 minutes.

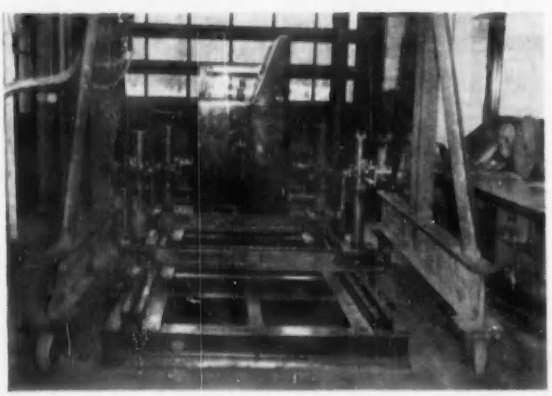
Cold water circulating in a series of pipes around the top of the tank prevent the vapor from escaping. This cold water condenses the vapor and makes it run into a trough. The condensed vapor is then purified and returns to the bottom of the tank. For each 8-hr period of use, eight gallons of chemical make-up is added. The entire 110 gallons of chemical are replaced every three weeks. Pure chemical under pressure through a nozzle is used to spray parts which can't be cleaned quickly by the vapor.

After the engine parts are cleaned they are taken to the engine rebuilding section of the shop where about eight engines are being worked on at all times. However, there is room for more if necessary. Here, as at the field shop, most parts are in such a condition that they have to be replaced. The rest are reconditioned and reused. Parts generally replaced are the piston and liner assemblies and the bearings.

Parts reconditioned and reused are the crankshafts, camshafts, con rods, cylinder heads, blocks, and injection pumps and nozzles. These parts are sent out to local repair shops or engine distributor's shops for reconditioning, since the Brewster shop is not equipped to do this. However, there are some things done here which are not done at any field shop. For example, when the cylinder heads are removed they are hydrostatically tested for cracks. The pressures used vary from 25 to 40-psi with head size.

Seat inserts and valve guides are replaced in the shop. A hydraulic hand pump is used instead of a large hydraulic press to put them into the head. This saves the time and labor of carrying the head back and forth from the press and it is easy to tell if the guide and seat inserts are

Rebuilt engines up to 500-hp are tested and run-in for eight hours on this Clayton dynamometer at the Bogota shop before being sent to the field or being installed in equipment at the shop.



After being rebuilt and run-in, a 200-hp Cat diesel is installed on a DW21 earthmover at the Bogota shop by Jim McGrath and Mario Fasciano (on ground). John Zabo operates one of two hysters which convey heavy parts, engines and equipment around the Bogota shop.

binding when putting them in. This prevents distortion with the resulting troubles. If the seats are in good condition they may only be refaced with a Hall-Toledo eccentric seat grinder.

Valves are usually replaced, but if their head thickness is adequate and general condition is good, they are refaced on a Hall, or Black & Decker valve refacer. These refacers are also used to square off the end of the valve stem. After the valves are lapped in their seats, they're checked for proper contact by bluing lightly all around the valve face and partially turning the valve against the seat.

After engines are rebuilt they are run-in on a Clayton dynamometer for eight hours. This dynamometer can handle engines up to 500-hp. Each engine must develop the same rating and meet the specifications of a brand new engine. Lou Menegus, the shop foreman, runs this dynamometer test.

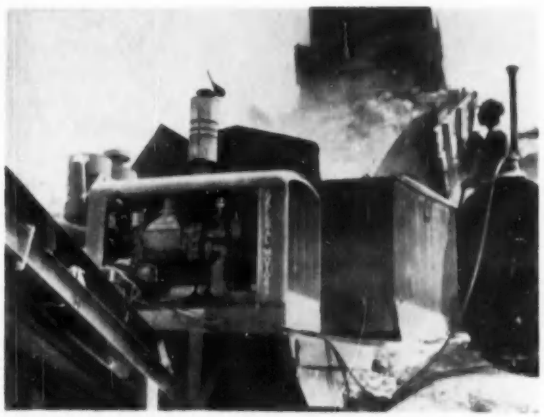
When the engine is first placed on the dynamometer it is started and run with a load of 3 to 4-lb ft torque until the engine is warmed up and operating temperatures and pressures are reached. Then engine is stopped and any fuel, lube oil or water leaks are fixed. Also, the cylinder head is re-torqued to correct specs and valves are checked and adjusted once more if necessary. Other parts are also checked and adjusted as necessary, depending on the make and type of diesel involved.

The engine is then started again, warmed up, and run at ¼-load for three hours, unless something abnormal turns up during this period. If something does go wrong, the engine is stopped, repaired and the 3-hr run at ¼-load is repeated. Then the engine is run at ½-load for three hours. This winds up the first day of testing.

Next day, the engine is started, warmed up under 3 to 4-ft lb load and then placed under full-load, full governor speed for two to three hours. If all's okay the engine is removed from the dynamometer, painted and installed in the equipment if it is in the shop, or sent to the field if it is to be installed there.

No records are kept on the exact cost of each engine-rebuild, or the time that it takes to rebuild it, such as would be done in a repair shop which sells their services to outside customers. They have to know. A spot check may be made by Mr. Freet, the equipment superintendent, from time to time on the cost of rebuilding one engine. This is done to see if it's costing more or less than it used to. According to Mr. Freet, it serves no purpose to know the cost of rebuilding every engine: it's more important that the job is done right to eliminate costly downtime.

It's also difficult to keep track of the time because a man may work on an engine one day or for several hours and then be called away to some more immediate job. He may not return to the original job for several days, sometimes. The more important or emergency jobs are done first, no matter when they come in. And each man is capable of working on almost any type of engine that is brought into the shop, or any phase of the rebuilding operation.



Diesel Powered Crusher Operates Profitably

FOUR years ago a Detroit contractor, Souter Sales, noticed the amount of old concrete being discarded. He had an idea—rework this scrap into roadstone for asphalt paving. Feasability depended upon how cheaply the concrete could be reworked.

Power for the operation is supplied by a Detroit Diesel 6-71 engine. The pressure-scavenged 2-cycle engine is rated from 154 to 223-hp, varying in rpm from 1800 to 2100. It powers a 25 x 36-in Universal jaw-crusher equipped with a single 30-ft conveyer for convenient loading of trucks.

Crushing concrete circulates highly-abrasive silicate dusts through the air, but preventative maintenance has kept cost to a minimum. Extra-heavy duty air cleaners arranged in series effectively trap these dusts and prevent their entering the engine. It has resulted in no noticeable increase over normal maintenance.

Souter Sales crushes up to 500-ton of this scrap concrete per day. The scrap is delivered by contractors and sidewalk maintenance crews looking for a convenient location to dump. It is generally in the form of sidewalk slabs and foundation blocks, removed to make way for sidewalk improvement and new buildings.

Unscreened and unwashed, the crushed concrete can be marketed at a price that enables contractors to cut material costs without reducing quality. The fusing characteristics of cement, plus its irregular shape provides a no-roll base that compacts better than roadstone.

Since its founding in 1952, the company's production has tripled. The capacity and economy of the diesel engine has met the increase without imposing penalties in cost.

A boring bar, with the cutter set to the proper clearance from the piston pin to be used, is shown entering the connecting rod bushing. The crank-pin end of the connecting rod is held rigid and perfectly parallel by a pneumatically expanded mandrel.

Precision-Fitting of Piston Pins

Piston pins today are being fitted to tenths of thousandths of an inch. Connecting rod bores must be parallel with accurate center-to-center distances. Here are details of a boring machine for pin fitting that does the job with accuracy and saves you time.

PISTON pins have to be fitted right. A bore that is fitted correctly will be straight, round, accurately sized, and uniform throughout its entire length. In addition, a line drawn through the center of the piston-pin bore will be parallel to the line drawn through the center of the rod-bearing bore.

The piston pin area is a zone of high unit pressures. If the piston pin is to live it must have a uniformly distributed load. High spots will take the brunt of the thrust. This results in inordinately high unit pressures, which cause a failure. Failures run up maintenance costs.

Running with higher than design unit-pressures is asking for trouble. If you do not get an immediate breakdown, the least you can expect is excessive wear, with resultant shorter life. You may, however, experience overheating of the parts because of the high-friction, scoring of the pin and bushing, and you may even wipe out the bearing metal.

Piston pin fits range from a heavy, or "palm" push fit, through lighter push-fits to the various specified clearances, often in tenth of thousandths.

Methods of getting fits are reaming, honing and boring. Boring is the most accurate, both as to hole characteristics and also alignment with the bore of the big end. Reaming and honing tend to "follow the hole".

Reaming is tricky. Unless it is expertly done it can produce chatter marks, and thus create high unit-pressure areas. These result in high wear, and excessive clearances.

With the modern engine's request for fits measured in tenths of thousandths, precision boring machines have been developed. And like all modern machinery, high precision is combined with speed of operation and elimination—to the greatest possible extent—of the possibility of human error. One such machine is built by Tobin-Arp. To show how they do the job, a few details of the machine will be covered.

The boring capacity of the complete machine, model PM-1000, is from a minimum of 21/32-in to a maximum of 4⅛-in. It holds connecting rods from 3⅝-in to 23-in in length, and will accommodate pistons with diameters as large as eight inches.

How It Works

As mentioned, the bushing is bored to align with the axis of the big end. The axis of the bushing in the crank pin end of the rod is centered as close as possible to the axis of the boring bar. Thus, when the bore is made it is in line with the big-end bore.

Both piston bosses and connecting rod bushings may be bored to give the proper fit, in accordance with the manufacturers specifications. All operations are done with equally controlled tolerances.

Pistons with new bushings, or being bored for oversize

pins, are usually aligned the same as the pin end of the rod. A mandrel aligned with the spindle is expanded in the bosses, and the piston clamped. The mandrel is then removed, and the boring bar installed.

Precision fit is a matter of machine accuracy and rigidity. The boring bar is supported in a way that allows it freedom of rotation; yet holds it firmly against whip. Two ultra-precision ball bearings are located on either side of the cut, so as to control the cut to within a fraction of a ten-thousandth. Also, the finishes that can be produced are within four to six micro-inches.

Incidentally, these bearings are about the only "don't" that the manufacturer stresses in operating and maintaining the pin fitting machine. These are super-precision ball bearings, and an air gun should never be used to clean them.

The cutter setting of the machine is governed by a device called a comparator. The cutting tool is set by specific comparison with the particular pin to fit the hole. This cuts the pin's exact diameter plus the clearance that is desired. Comparator setting is graduated in ten-thousandths, controlling the cut to a fraction of a ten-thousandth of an inch.

Thus, every phase of the boring operation is closely controlled. Connecting rods can be bored with an accurate center-to-center distance between the big-end and the piston-pin bores. Parallelness between these two center lines can be held well within the specifications of any manufacturer.

Let's look at an imaginary man operating this very real machine, and see how he does it.

Procedure

A step by step procedure in the operation of the pin fitting machine, in boring a connecting rod, would be as follows:

The operator would first set the specified center-to-center on the vernier scale of the upright column designed to support the rod. Next, the two bearing assemblies (remember those ultra-precision bearings) are moved into position. Air-operated clamps hold them there.

Once the bearings are in place, and the vernier scale is set, a mandrel is expanded into the crank-pin end of the connecting rod. The mandrel and rod are then placed in the mandrel holder assembly on the column. This sets the big end.

Another smaller mandrel assembly is then placed through the boring bar bearings of the machine, and into the piston pin end of the rod. These two mandrels are automatically centered by the machine.

The operator pneumatically expands the blades of the smaller mandrel. This action centers the crank pin bore (held by the larger mandrel) with the bore the machine is about to cut.

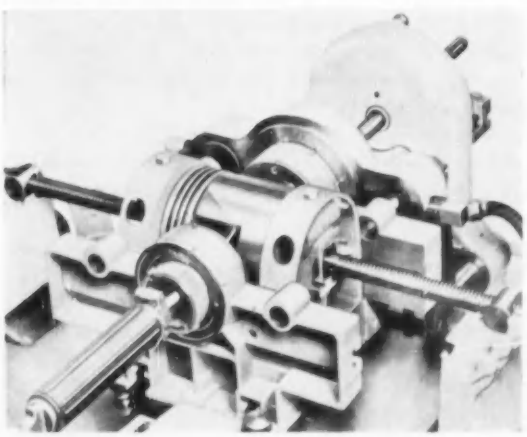
Now he is ready to pull the clamping button on the front of the machine. As he does so, two clamps come in, one from the front and the other from the rear, to securely lock the rod in the proper position.

He now releases the clamping pressure on the blades of the smaller mandrel, and removes it from the pin bore. Through the same bearings, he inserts the boring bar—with the cutter set to the proper clearance. He connects the cutter to the drive spindle of the machine by means of a quick coupler. He snaps on the motor switch; then the feed.

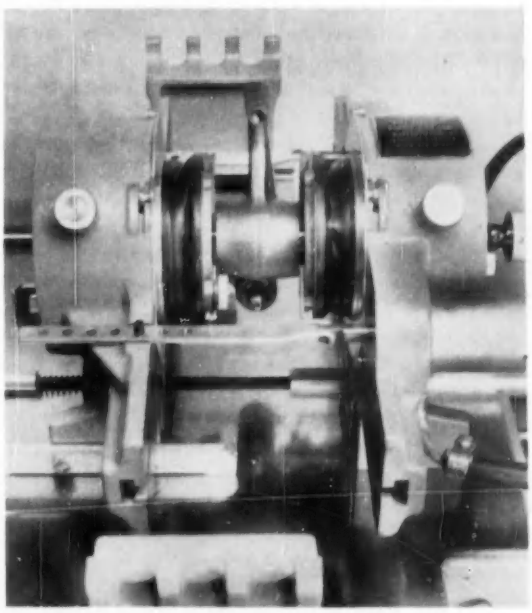
The feed operates in either direction, and has separate controls to govern the rate either way. From this point, the operator will normally require from eight to ten seconds to feed the cutter through the bushing.

(Continued on Page 72)

A mandrel, aligned with the spindle of the Tobin-Arp machine, is pneumatically expanded in the bosses of a piston, then piston is clamped. The mandrel is then removed and boring bar put in.



Here's a close-up of precision bearings located on either side of boring bar cutting through rocker arm bushing. These ball bearings prevent boring-bar whip and control cut to fraction of a ten-thousandth of an inch. A comparator governs the actual cutter setting.



The 317-cu in. engine of this Ford truck has been replaced with a 426-cu in. diesel. Principal external evidence is seen in the hood latches and the two openings cut in the grill bar for increased flow of air.

Re-Engining for Power, Performance, Economy

by **Stuart A. Woodward,** Waukesha Motor Co.

Today's diesels pack more wallop in less space. Performance and economy are greatly improved. Re-engining is practical—if—you know what you're doing. Here are some practical ideas.

YOU can get that added power of the improved performance you want from your present equipment. Replace the engine. It's a practice that is widely followed and one that can give excellent results. When a diesel replaces a gasoline engine, important economic advantages are obtained.

Engine replacement is going on in equipment ranging from jeeps to big shovels. The jeep and similar light vehicle conversions are often made to take advantage of another diesel advantage—safety. Absence of an ignition system, much less toxic exhaust gases rendered still safer by exhaust scrubbers, combine to make such vehicles suitable for underground mining and other services in confined or hazardous areas.

With the larger equipment—shovels, cranes, drag-lines, trucks, etc.—the higher power and greater usable torque increases capacities and/or speeds up work cycles. This is done with greater economy and lower maintenance.

Experience with a great number of re-engining jobs has shown us the wisdom of treating such projects with a great deal of respect. There are two parts to the job—the engineering phase and the actual mechanical work. Both require a great deal of study and skill. Experience is a big factor, too, if costly mistakes are to be avoided.

For many years Waukesha has devoted considerable attention to re-engining problems with the result that today we know what engine should go where and how to install it. Drawings of the modifications necessary to the vehicle or piece of equipment, step-by-step procedures for the work and even lists of needed parts and supplies are on hand.

This headstart not only insures a successful job but cuts the time element drastically. If you go into a job cold, cut-and try methods and procurement of even simple items will drag out the downtime when the piece of equipment could be earning for you.

What are some of the problems? There are enough to fill a good big book but we will try to outline some of the major ones.

What Do You Want To Do?

This question is not as simple as it sounds. Your objectives must be specific. The big cry is for greater economy! Economy in terms of what? Let's talk about truck operation. Higher average road speeds mean economy. But so do higher capacities at the same average road

speed. Or you could be satisfied to accept normal economies of the diesel versus an equivalent gasoline engine when hauling the same load at the same average road speed.

You must know exactly what you are shooting for before you can even make a preliminary selection. Analyze your cycles of operation. Decide on the load to be carried. You know your maximum legal road speeds, so if the average road speed is to be boosted, you'll have to make the grades faster. And don't forget those empty runs. You may have to figure on an overdrive to hold engine speeds within limits.

Now let's get down to a specific case. Suppose that you owned a Ford F-8 truck-tractor and that you decided that more power and diesel power was the answer. You select the Waukesha 135-DKB engine, one that we recommend for this conversion. The Ford is a 317-cu in engine with a torque rating of 286-ft lb at 1700 to 2300-rpm. The 135-DKB has a 426-cu in displacement with a maximum torque rating of 328-ft lb at 1600-rpm.

Mounting the Engine

It's a sure bet when re-engining that some chassis and body changes will be necessary. Engine size, comfiguration, location of accessory equipment and mounting brackets will vary. Ask any hot-rodder.

In this case, the front cross chassis member had to be modified to accept a new member that provided a dual-mounting for engine and radiator. The engine pan was raised over the axle by using 1½-in blocks between springs and axles. New rear engine mounts, right and left, had to be made. Right here we run into a reminder that you never do one job alone; it is always part of an integrated whole.

Ford uses a Clark 205 transmission in the F-8 and F-9 trucks 1949-1952; Clark 265 from 1953 to the present. While it is being used successfully with the 135 engine, they are a little on the light side for the higher torque delivered. If a heavier unit is to be installed, the Clark 290-V transmission is recommended for use with the 3-speed auxiliary transmission offered as optional equipment in Ford trucks.

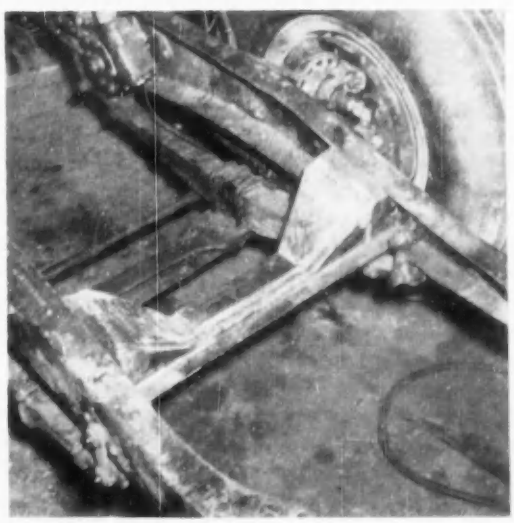
Ratios for this 3-speed unit should be 2.0; 1.0; and 0.73. Best rear axle ratio would be 7.80:1. In this truck the rear axle was an Eaton 17,000-lb, 2-speed electric shift axle with 6.5/8.86 ratio. Tires were 10.00 x 20 and the overall ratio with the Clark 205 5-speed, fifth overdrive unit, in fifth gear overdrive was 5.19. This gives a top loaded speed at 2600 rpm of approximately 59 mph.

Next best possibility would be a Clark 280-VO transmission with overdrive and 2-speed rear axle. The point is that the driveline must be considered (1) as to torque capacity and (2) as to suitability of ratios to permit the engine to operate at optimum speed and not overspeed in the contemplated type of operation.

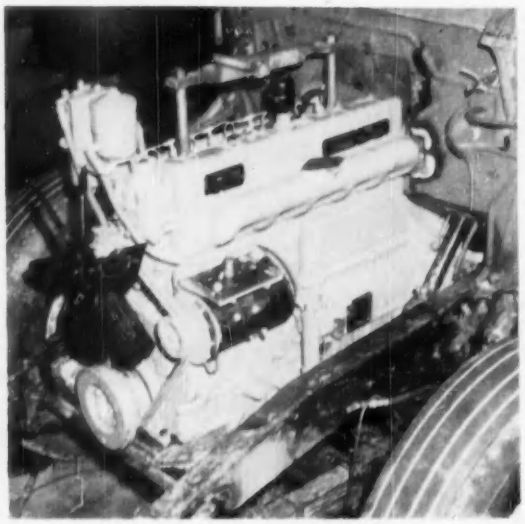
All this affects engine mounting because either a No. 3 SAE housing (recommended) or a No. 2 SAE housing can be used to replace the dual-type Ford bell housing. Rear engine supports will vary, depending upon the housing used. Another phase of good engine installation is the selection of the proper rubber engine mounts.

Then there is the problem of matching up and connecting engine and transmission units. For example, if you were going to use the recommended No. 3 SAE housing with the 205 transmission you would need special parts. For the clutch this would include its housing, release yoke, release sleeve, pedal shaft, stub shaft and release bearing. You would also need a transmission front shaft and a bearing cap. And with this combination the Ford drive shaft is shortened 3⅛ in.

It's a fairly safe bet that when you re-engine you will have to modify the chassis and the body. Here, the front cross member was modified to accept a radiator-engine mount member.



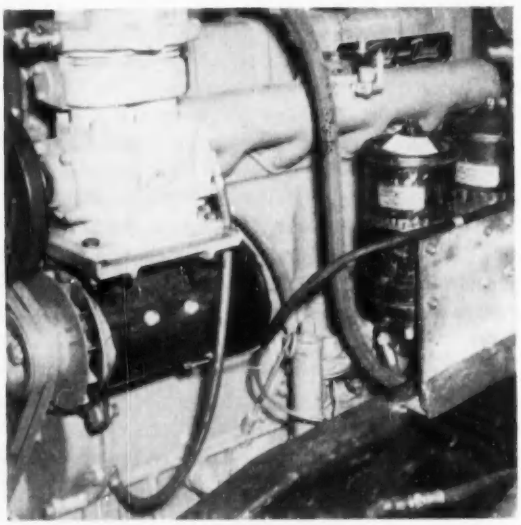
In this installation, a new set of engine mounts were required, for the rear, too. Another thing to consider in a good installation is the selection of proper rubbers for the engine mounts.



Above. With engine mounts complete and firewall reworked, the engine can be installed. In this case the firewall had to be "bumped" to provide clearance for the removal of the manifolds.

Top right. Floorboard insert is cut to accommodate shift lever and brake, moved back by longer engine. Cross-shaft connects accelerator to link running through firewall to the governor.

Right. Lube oil filters as normally mounted on engine interfered with the steering sector. New bracket was chassis-mounted for their support and connected up by flexible hose lines.



Body changes must also be made. With the whole engine-transmission unit 3⅛-in longer, the floorboard insert is reworked to make openings for the shift and brake lever. The firewall must be "bumped" to give clearance for removal of both manifolds and the head temperature bulb at the rear of the head.

Now let's assume that the engine is mounted and properly connected to the drive line. Done? Not by a long shot. There are still the matters of control and various engine systems and accessories to worry about.

Engine Systems

Just about every engine system with the possible exception of the lubrication system (it is pretty well self-contained) must be considered. The success of a re-engining job can well depend on the attention given these items.

Starting System—A change over must be made to a 24-v starting system. This means either a 24-v battery, (two 12's or four 6's), same voltage starting motor, a 12-v generator, regulator and a series-parallel switch. Lights and other battery-powered accessories (heater motor and dash instruments, for example) will have to be changed to 12-v or the proper resistors inserted in the circuits. Voltage control rheostat units can also be used to handle 6-v and 12-v trailers.

Space will have to be found for the battery. In this particular case it was mounted in a fabricated steel box fitted behind the driver's seat. The series-parallel switch was mounted outside the frame rail behind the right-hand running board. In connecting these and the other electrical

components, the right sizes and lengths of wire, lugs and connector blocks should all be on hand. Otherwise, the wiring job can run into an unjustifiable amount of time.

Engine Controls—Controls will have to be altered to suit the new engine. The accelerator must be connected to the fuel injection pump. Here, a throttle cross-shaft was mounted on the vertical part of the firewall inside the cab, and the throttle shaft run through the firewall to the pump. A return spring clipped to this rod.

A fuel shut-off is needed. It may be a solenoid type or a manual bowden wire control. In this particular case, a cluster of push-button controls were mounted in the center of the dash in the space usually occupied by the radio. In addition to the fuel shut-off, there were buttons for simultaneous operation of the glow plugs used with the 135 engine series and the starter.

Piping—Fuel systems will require reconnection and flexible hose such as made by Aeroquip is excellent for the job. Fuel lines were made with ⅜-in hose and both supply and return were taken from the right-hand saddle tank. A ⅝-in balance line, protected by a piece of angle iron, connected the tanks.

Water supply for the air compressor was taken through ⅜-in hose from the water outlet elbow of the head. The return ran to the water pump inlet elbow. A ⅝-in hose connected the compressor to the air tank and a ¼-in hose ran from the compressor governor to the unloader.

Although it was mentioned that lube oil systems are not normally modified, this does not necessarily apply to the lube filters. In this case there was interference between the engine-mounted filters and the steering sector. The two filters were moved from the engine to adjacent space that was available. Hose connections were made in accordance with the normal oil flow. An alternative of this would be to use a remote-mounted Luberfiner 500 or 750-C filter or its equivalent with the accompanying mounting pad.

Piping must also be arranged for the intake and exhaust systems. The increased amount of air required by the diesel means a larger air cleaner. It is moved outside the hood for two reasons—space factors and to obtain cooler air. The intake air pipe was passed through the top of the right-hand fender, through the splash panel and to the intake manifold flange.

The exhaust pipe was made from an International-Harvester 190 exhaust pipe and muffler. The vertical stack was held by a 3-in saddle clamp to an angle iron bracket mounted right on the truck frame.

Cooling System—A lot of thought must go into planning the cooling system. With more power, heat rejection to the cooling water will be higher and even when an engine of the same power is used there is the problem of whether the components will be suitably matched.

In any heat transfer problem, you must consider the velocity and volume of flow, the temperature of the fluid being cooled, as well as that of the coolant, and the amount of heat transfer area. These must be properly balanced if normal engine temperatures are to be maintained under conditions of maximum load and high ambient temperatures.

Both the velocity and amount of water circulated will depend on the capacity of the water pump and the restriction of the radiator and piping. For example, if a high-capacity pump is used in conjunction with a radiator that is too small or has high pressure-drop characteristics, you'll fill the expansion tank and even pump water out the overflow. And, of course, cooling will suffer and heads and block will crack.

The amount of heat transferred from the water to the air will depend basically on their temperature difference and the amount of heat transfer area of the radiator. This will be modified by the flow characteristics on both the water and air sides. Radiators are designed to provide air turbulence for maximum contact with the heat transfer surfaces. The volume available for cooling will depend on the radiator's restriction to flow; the size, type and speed of fan used; fan efficiency as affected by shrouding, grill design, etc.; and the "ram" effect of vehicle speed.

Any or all of the components may have to be changed to meet the cooling requirements of the engine. In this particular case the original Ford radiator was used, although it was recognized that its cooling capacity was marginal for this installation. It might not provide adequate cooling during high summer temperatures, in which case a larger core would be fitted.

The radiator was reworked for a 2-in inlet fitting and a 2½-in outlet fitting. It was also moved 6-in forward to accommodate the added length of the in-line engine. This move involved some body and fender work to accept the radiator in this position. Included in this was the cutting of two openings in the grill bar totaling about 64-sq in. in area to increase air flow to the radiator.

Conclusion

Through proper engineering it is possible to select and install all of the components necessary to do a good re-engining job. The success in operation is proportional to the skill and experience applied. When it is done right, you will meet your objectives.

Re-engining is not a job for the neophyte; it takes engineering skill and experience. To give you an example, we have been in the re-engining business for years. Yet there are aspects of this particular job that were "firsts". Some 150 to 160 man-hours went into the job. Many were spent in careful checking and considering optimum engine locations before the work started. In subsequent jobs in similar trucks, 90 to 100 hours was adequate.

So if you want the benefits of re-engining—and they can be substantial—take advantage of the experience of many years. We are ready to provide complete information for any type of replacement engine installation. It can save you money and give you the operational advantages that you want.

Maintenance Tips from the Railroads

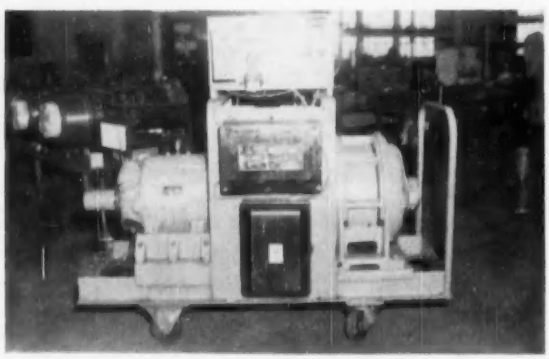
Cost-conscious railroad management is always looking for new ideas to save time and money. Here are a few.

MECHANIZATION and Automation are continually emphasized by cost-conscious railroad managements to all departments. Because of potential economies in diesel locomotive maintenance, mechanical officers and supervisors are particularly interested and active.

Time study and cost control investigations point out many weak spots, and highlight numerous operations which take excessive manhours. Many of these can be reduced by appropriate tooling. Functions of maintenance officers and supervisors are to provide or develop the proper tools and procedures to perform the work efficiently, as well as to improve the quality of diesel maintenance.

As reported in previous years, shop-designed and built devices are still considered most important. It is common knowledge that hundreds of ingenious and useful devices have been developed on the railroads generally, and a few of them have been brought to light.

In the following paragraphs we will see some more of the devices which were originated and are now used in the shops of various railroads. In the main, these were reported by the Shop Equipment Committee of the Locomotive Maintenance Officers Association.



Portable M-G Test Set

This set is used for making tests on steam generators while diesel units are being repaired. It is also used on units having just received heavy overhaul, and the engine is not yet ready to run. This procedure allows the locomotive to be in service sooner.

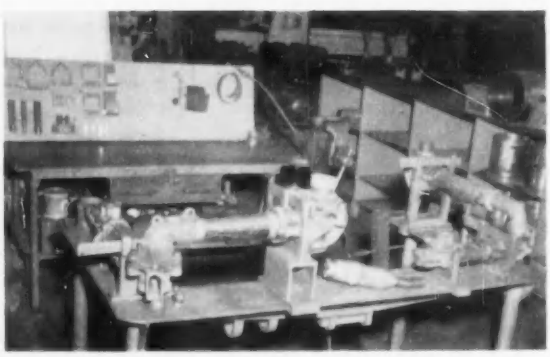
In assembling this portable motor generator set, use was made of a standard 10-KW EMD auxiliary generator, complete with voltage regulator.

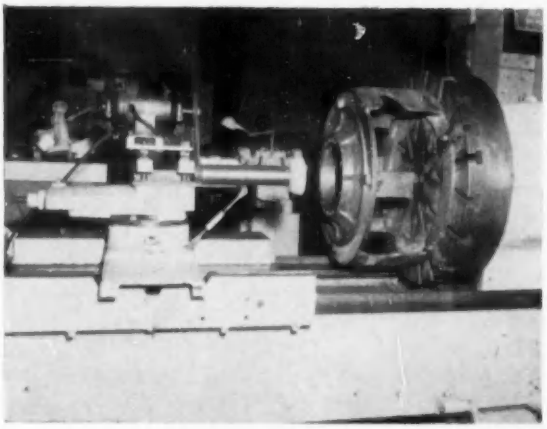
Connector Repair Bench

This "U" shaped metal bench is used to repair steam-heat metal connectors (used between units). One side accommodates 2-in; the other 1½-in. conduits.

The outer end of the holding fixture slides to suit different length conduits. Conduits are held in place during assembly and disassembly by taper wedges. Impact wrench on bench facilitates the work.

Gauges and chart on back of stand show standard length of conduit for different power.





Grinding & Metalizing To The Fixture

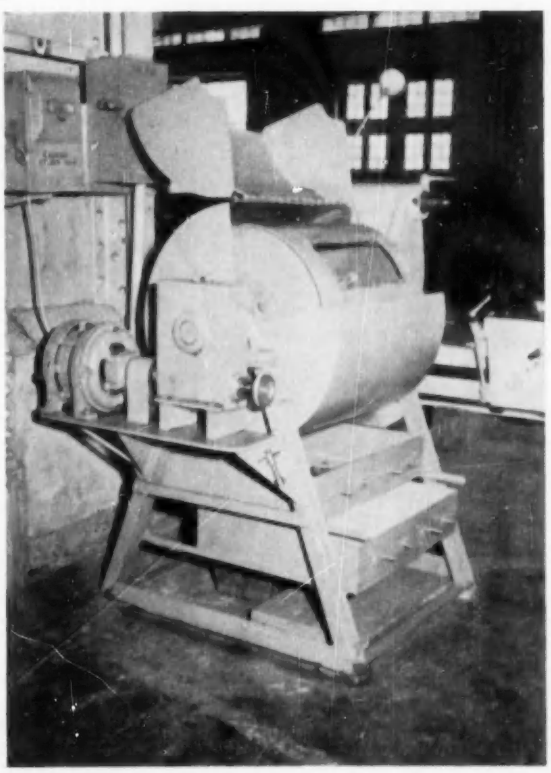
This fixture is used for reclaiming traction motor bearing housings. Note that it is made with a large cutout section. This is for the housing to be dropped between the ends of fixture and bolted into the self-aligning bore.

An out-of-round bore is ground only enough to clean it to a perfect circle. Then a portable metal sprayer (using bond-spray only) applies just enough metal to allow grinding to proper size. A predetermined undersize pin-gauge is used in this connection.

Several standard-size recessed grooves are made in the face plate of this 36-in. lathe to accommodate smaller fixtures. One such groove is used to hold the end-bell of main generator bearing housing.

TM Cable Disconnecting Tool

This tool consists of a pair of slip-on hooks, formed from steel by flame cutting. The later design (on right) are slightly upset on the tail, where a ½-in square hole accommodates a ½-in ratchet. This permits any desired angle of pull in order to most easily disconnect EMD traction motor cables.



A Tumbler Cleaning Machine for Small Parts

This is a drum, motor-driven through worm gearing to operate at 20-rpm. Its interior has several ¾-in angle-irons spot welded to the drum at an angle that turns over parts being cleaned.

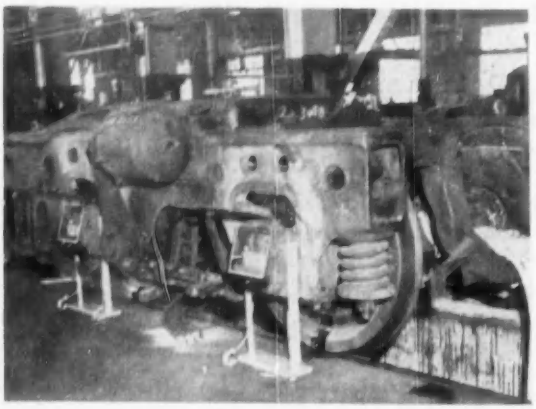
All parts are first put through cleaning tanks (in wire baskets) containing suitable solutions for soil to be removed. Then the baskets are dumped into the drum along with the abrasive cleaning material—ground corn cobs—and the cover applied and held by six ⅜-in studs.

After rotating a sufficient time to finish-clean and polish the parts, the drum cover is removed and the drum is rotated. It drops its contents into the top pan. This pan, having a wire-mesh bottom, retains the cleaned parts while the abrasive material falls through into the lower pan. This material is saved for reuse.

This machine can be used for cleaning and polishing a wide variety of small parts. It eliminates the use of wire brushes.

One unit is used in the electrical department for cleaning small parts, including brush holders; another in the cylinder-head area of an engine overhaul shop.

Defects in valve springs and other engine parts can be detected after being cleaned in this way.



Journal Box Holding Device

This device was developed to reduce the number of men needed (one for each journal box) to hold boxes in position when lowering truck frame over wheel and journal-box assemblies. Using this device only one machinist and helper are needed when wheeling a truck.

Device consists of a ¾-in plate base, two pieces of steel angles, and two spring clips with retaining chains. The spring clips hook over top edges of boxes to hold them straight. They are then in position, as the truck pedestal jaws are lowered over them by a shop crane.

The same device is adaptable for use on a truck work stand by shaping the base hook over the stand frame.

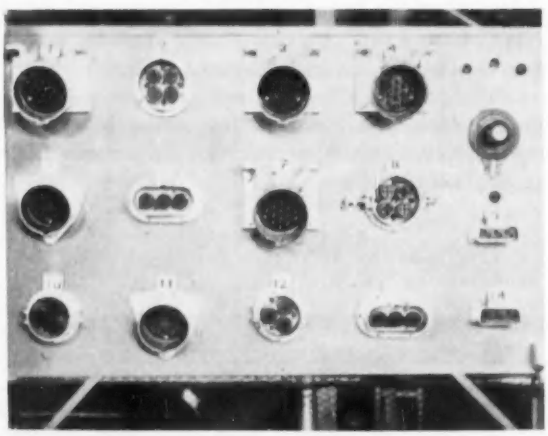
Control & Cable Testing Board

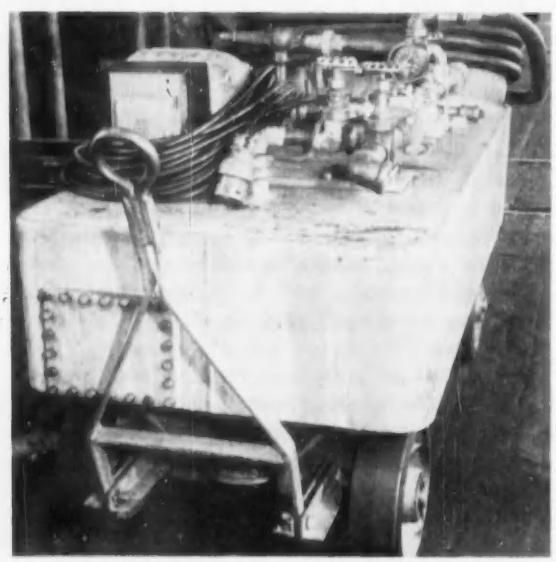
This board is equipped with receptacles, rheostats, indicating lights, and wiring. It provides a simple means for quickly testing any control or jumper cable for continuity, grounds or short circuit.

Both ends of the cable to be tested are plugged into the correct receptacle on the board. A rheostat-pointer indicates the number of the conductor being tested. As the rheostat is moved from one step to the next, a light indicates continuity.

If a plug is grounded or wires are short-circuited, a ground or short circuit lamp will light.

All control cables, including those for electric braking, can be tested with this equipment.





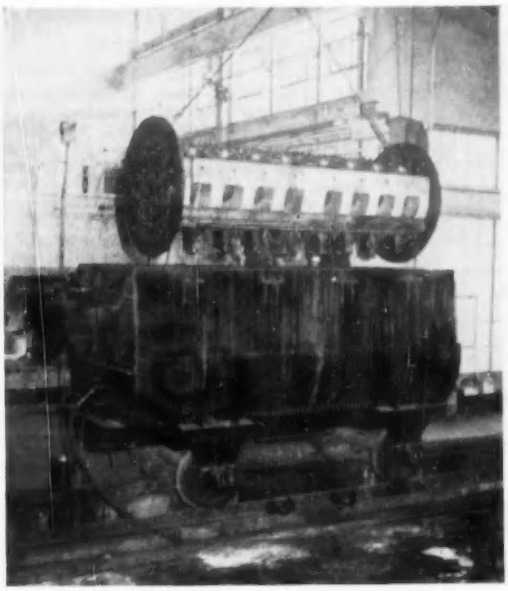
A Good Used Lube Oil Wagon

These wagons are used in shops with both a clean and a dirty oil pipeline system. However, there are times when the work to be done on the engine necessitates draining lube oil that is neither diluted nor due for scheduled change. In such cases, the engine drain-outlet is connected by a hose to one of these wagon-tanks, instead of to the dirty oil pipe line.

A motor-driven rotary pump on top of tank delivers oil to the tank, which holds the lube oil from one engine.

After the drain hose is disconnected, valves are manipulated to pump the oil from the tank through a Michiana filter unit at end of wagon. It then returns to the tank. This recirculation is continued for a time sufficient to insure adequate filtration.

After the work on the engine is completed, the pump is again used to put the still useable oil—filtered and clean—back into the engine.



Engine Frame Cleaning Tank

Effective and thorough cleaning of all sludge and dirt from interior corners and crevices of a diesel engine frame requires agitation or movement in the cleaning solution. This arrangement provides a means for rolling the frame in the solution tank, thereby cleansing it thoroughly.

This tank has a semi-circular bottom, 3-ft. 3-in. radius, with straight vertical sides. It provides a maximum depth of 7-ft. 2-in., and a length of 15-ft. Top cover is hinged, and has V-shaped guide members at one end. Steam-pipe coils inside heat the solution.

Two long rollers, 10¾-in diameter are supported by sealed bearings. Idlers are located inside near the bottom of the tank. Roller shafts are extended at one end, and have chain sprockets at the end.

A 3-hp gear motor is mounted on the outside of one end. The drive shaft is coupled to a short shaft that extends through the end-wall. This shaft has a sprocket wheel. A roller chain connects it to another on one of the roller shafts. This provides a positive drive for the rollers.

Two circular plates are bolted to the ends of an engine frame. Each has an outside rim 1½-in thick with a flame-hardened face welded to a plate. These plates are drilled for mounting bolt-combinations to suit the frames to be handled. Openings permit the flow of cleaning solution to ends of the frame.

After plates are bolted in place, the frame is lowered into the tank by an overhead crane. With circular end-plates resting on the power driven rollers, the frame is rotated in the solution. All passages and corners are thoroughly cleaned and flushed.

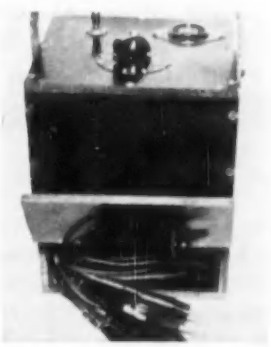
Cleansing solution is thoroughly rinsed from frame after its removal from tank.

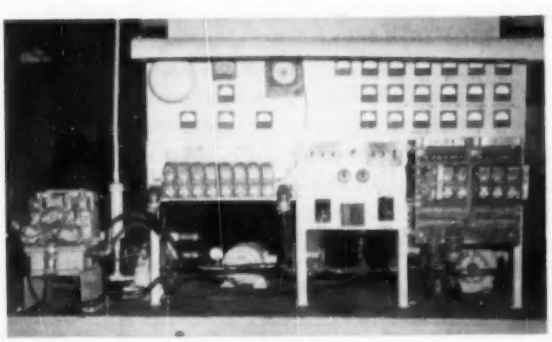
Alco Control Test Panel

This control box is approximately 8-in wide, 8-in long, and 12-in high. It is provided with an eight-point control switch (same as throttle) and a toggle switch for the generator field circuit.

Its testing position is on the platform in the electrical cabinet of a "B" unit. Its test cable leads are then connected to the proper terminals of the board in the low voltage cabinet. Engine speeds are checked by moving the control switch from one point to another.

The test-lead cables are carried in the lower compartment of the box when they are not being used.





A Small Control Box for "B" Unit Operation

This is another type of testing panelboard for testing control panels, tachometer generators and 400-cycle generator sets on ALCO DF-7 and DF-7X diesel locomotives. Provisions are made for tests of this equipment over the entire range of operation, thus simulating actual road conditions. The parts can be tested, and settings checked, adjusted and calibrated all in one operation.

Considerable ingenuity and resourcefulness is shown in the design of this panel.

(Continued on page 74)

The Pacific Intermountain Express diesel repair shop at Denver, one of the largest and best equipped in the country, uses a large V-B machine for faster and better cleaning of carbon, varnish and corrosion from truck engine blocks, pistons, liners, valves, fuel injectors and other parts. Piston cleaning time alone was reduced from the fourteen hours required by the old method to about one hour when using the new Vapor Blast cleaning process. Lever at left of operator's knee is for controlling the air pressure to abrasive guns. Motor controls for pump and fan are located above observation window.

Make Parts Cleaning Easier

New method of cleaning engine parts by vapor-blasting and liquid honing with abrasives without disturbing precision tolerances makes cleaning easier, cuts labor time and saves money.

IF you have cleaned pistons, liners, valves, injector tips, etc., the hard way this is for you. Hand scraping ring grooves, for example, using steel wool on piston skirts and wire brushing the crowns to remove hard carbon and stubborn lacquer is tough work and tedious. No argument there. But with today's modern cleaning methods, brought about by expanding industry's demands, this monotonous and time-consuming labor can be over.

Today, instead of five men with hand scrapers, steel wool and wire brushes, a better cleaning job is done by one man—in a specially designed, semi-automatic machine. Pistons are cleaned more thoroughly, more uniformly and precision tolerances in ring grooves are easily maintained all at only 20% of former costs. This is the story of only one of many diesel service and repair shops which are using a new wet-blasting process primarily for cleaning engine parts but also for many other applications.

In this machine developed by the Vapor Blast Mfg. Co., more than 50 different kinds and sizes of abrasives can be used. These range from a very coarse 20-mesh to 5000-mesh which is about 10 times finer than face powder. These abrasives, properly selected and suspended in water and in chemicals, are forced by air through a nozzle or nozzles in the machine against the surfaces of the parts to be cleaned.

By proper selection of abrasives the exact degree of cleaning or metal removal can be obtained without disturbing precision tolerances. This, gives the machine a wide range of applications and makes it a very handy tool.

For example, cleaning action can be controlled to provide finer, the same, or rougher finishes. Extremely fine finishes would be desirable, for instance, in the case of injector tips. On the other hand, a matte (dull satin) finish can be produced on liner walls, pistons, or other metal surfaces where a glaze is not desirable. Oil clings in the micropockets of the duller surface, reducing break-in time and giving good anti-friction protection.

The machine's liquid honing operation is so precise,

that the Cummins Engine Co. uses it for removing the burrs that result when drilling the tiny holes in their fuel injector tips. Conventional methods were too slow and costly for today's production demands. The new method rapidly cleans and produces a smooth surface which promotes better fuel flow and cuts down gum and carbon deposits.

The V-B process has its advantages also when used in the machine shops doing actual repairs on diesel parts. For example, tools received from the vendor can be cleaned so well that as metal smears are removed hidden defects become visible. Frequently, tools inspected and approved by other methods are actually defective. This process shows up the cracks by removing the smeared metal covering them. These tools can then be returned rather than have them break in a short time. In addition to the tool loss, setup costs are increased because of short runs plus the danger of damaging engine parts being repaired.

One benefit reported by many repair shops is that liquid honing of cutting tools has sometimes increased their life as much as 200%. Tools in which grinding marks from sharpening are opposed to the direction in which the tools—reamers, hobs, broaches, etc.—cut are particularly improved. Metal "fuzz" or feathered edges are removed thus reducing friction and giving in effect a "broken-in" tool. In liquid honing cutting tools, the blast of the abrasive is directed toward the cutting edge. Since this blends or removes grinding marks, stress concentrations are reduced and fatigue failure or chipping at the cutting edge is minimized.

The many benefits obtained from the V-B machine are by no means limited to the servicing and repair shops in the field. Engine manufacturer's foundries and machine shops have also found it to be of great use.

In making new molds and dies liquid honing is used to advantage from the initial examination of the steel. Heat treat scale removed by this process leaves a smooth matte finish suitable for immediate use in many cases. Light metal deposits and carbon are cleaned faster and better out of cores and cavities. The surfaces have greater resistance to carbon, allow freer flow of metal and better lubrication control on die surfaces.

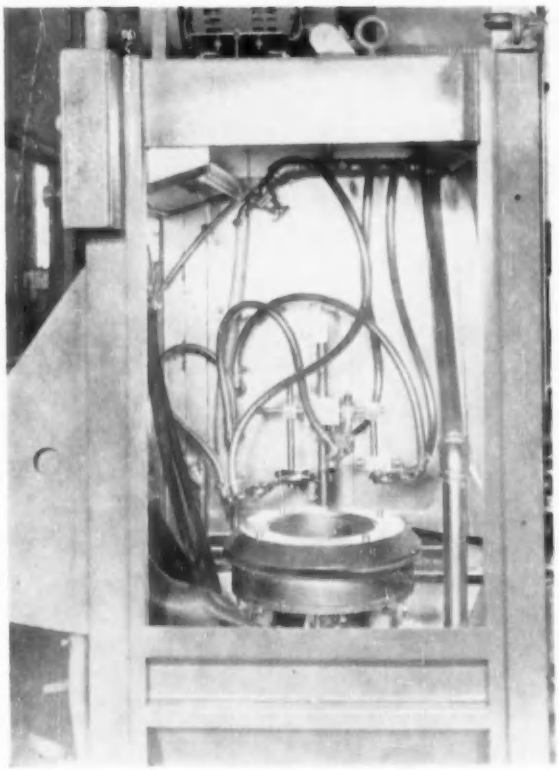
Now let's see—

How The Machine Works

A V-B machine does a blasting job which is a refinement of dry sand or steel blasting in that the use of fine abrasives permit precision jobs to be done without destroying size tolerances, while maintaining low micro-inch finishes.

A sand blast machine uses steel shot, steel grit and coarse sand for their mechanical abrading properties. Fine sand and abrasives can't be used because these machines are arranged for gravity feed of the dry abrasives from hoppers. The angle of repose of the material increases as it gets finer and it won't feed.

A V-B machine can use fine abrasives because they're mixed with water and chemicals and are uniformly agitated in suspension and fed to blasting guns by a motor-driven centrifugal pump. Abrasives as fine as three microns can thus be used.



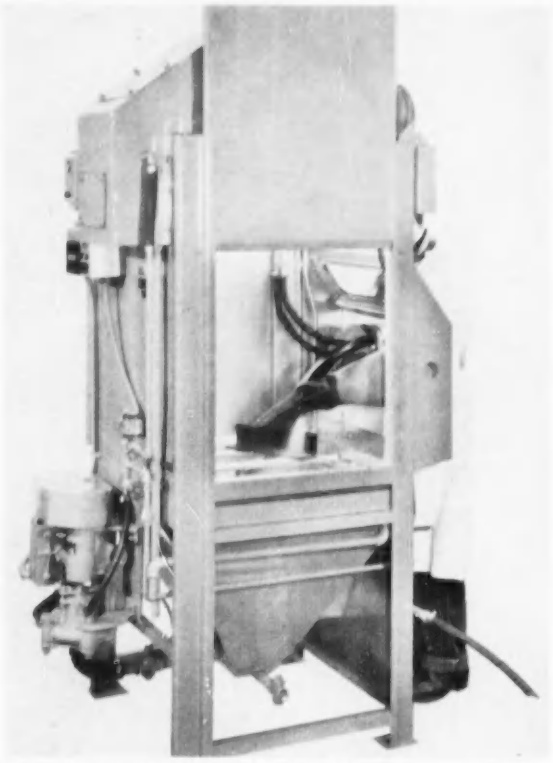
Interior of V-B piston cleaning machine. Rotating device in center is for holding piston. A special adapter ring can be quickly mounted to handle smaller size pistons. A manually-operated gun for "high-spotting" and cleaning piston crown is held by hand at lower left. An internal abrasive gun in center of piston-holding and rotating device, moves up and down inside of the piston to clean its interior. Three guns for cleaning outside of piston are above piston-holding device. Mechanism for raising and lowering guns over face is behind the guns.

The pump feeds abrasive slurry to the blasting gun while compressed air forces it through. Thus atomized water and abrasives are given extremely high velocity, which, along with the numerous particles thrown out, cause a blasting action.

In actual operation, the pump on a V-B machine delivers about 30-gpm of slurry consisting of 35% abrasives by volume. About 6-gpm are delivered to a standard gun while 24-gpm are by-passed back into the hopper. This circulation creates the violent agitation necessary to maintain the abrasives in suspension for uniform blasting results.

The operator controls blasting air to gun with his right knee. To provide maximum visibility, an exhauster fan on the machine gives more than five complete air changes per minute. This fan pulls air through a ventilating unit containing a metallic filter which is automatically washed by spray nozzles for 90 seconds every half hour. The operator can flush a light glass and observation window with his left knee for maximum visibility.

For manual operation, the operator works both the part



Sliding door at side of V-B machine is raised to place parts inside the machine. Hands of operator at right can be seen inside machine handling a manually-operated abrasive gun. He can see what he is doing through window at right, just above his arms. Operator controls blasting air to gun with his right knee while handling gun and part being cleaned. Motor-driven centrifugal pump delivering abrasives, is outside.

being cleaned and the gun, using the proper abrasive, air pressure, gun distance and angle, etc. to get desired results.

For example, a piston is placed on a special rotating device built inside the machine. Three V-B guns are pointed at the piston walls. As the guns are raised and lowered over the face of the piston, automatic controls turn on all three guns as they pass over the ring grooves at the bottom and top of the piston.

Two of these guns are turned off as they finish cleaning the grooves, leaving one to completely clean the piston wall. A fourth gun, located in the center of the holding ring, moves up and down to thoroughly clean the piston interior. A manually operated gun is used for cleaning the piston crown and for any high-spotting necessary.

The entire cleaning operation on one piston takes only about eight to ten minutes—including loading, automatic cleaning cycle, cleaning crown and rinsing. V-B 140 QVB abrasive has proved best for this operation. No hand scraping or finishing is required.

To make sure that the V-B machine works properly and produces the fine results of which it is capable, its operation must be accurately controlled. There are some things that should be done and others that shouldn't be done to get best results. Lets look at some of these—

Cracks and other defects in carbide tipped tools are readily visible after smeared metal is removed by liquid honing. Moisture trapped in the cracks oozes out when the surface of tool is dry, making defects even more visible.

"Do's" and "Don'ts" in Operation of Equipment

Clean light glass and observation window periodically for maximum visibility. Maintain proper air pressure. Maintain proper abrasive percent in hopper solution. Wash parts free of abrasives immediately after blasting and while still wet. Use best blasting angle, 45-deg to 70-deg for cutting, 70-deg to 90-deg for peening.

Don't process oil-covered parts. Oil forms an emulsion scum which reduces blasting efficiency and causes stains. Don't deburr steel parts and finish precision non-ferrous parts with the same hopper solution. The steel chips may damage the softer precision parts. Don't over-blast if size tolerances are to be maintained.

Don't attempt to blast long blind holes without using a special gun. Don't direct blasting stream directly or by ricochet into light glass or observation glass. Don't operate machine without some type of rust inhibitor in the hopper solution. Don't allow foreign materials to fall into hopper solution. They may lodge in one of the pump impeller openings and reduce pump capacity.

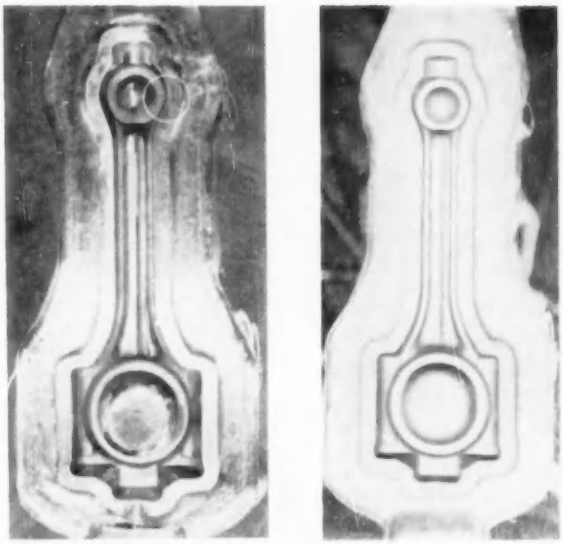
Types of Abrasives

The actual types of abrasives used in V-B are:

Organic (walnut shell, peach pits, etc.); novaculite; silica; quartz; garnet; aluminum oxide; other refractory abrasives higher priced; and "Brite-Shot".

Briefly, these abrasives would be used as follows. The organic materials are used only for mild blasting operations. The novaculite, being a soft type silicon dioxide, would be used for fine feather burr removal, creating very fine matte-type surfaces while maintaining low micro-inch adjacent areas.

The silicas, which are slightly more agressive than novaculite, can be used for larger burrs and faster scale removal but a higher micro-inch finish usually is obtained except with the very fine silicas. Quartz abrasives are more



Diesel engine connecting rod die at right is seen after liquid honing. Mottled appearance at left has been changed to matte finish eliminating costly polishing. Die life is also extended.

aggressive than silicas and last longer. More tenacious burrs can be removed and scale is removed very rapidly with this type.

Garnet abrasives have long life and are very aggressive. A comparable mesh size of garnet as opposed to a silicon dioxide will produce a rougher surface. Aluminum oxide and other artificial abrasives are the most aggressive and erode materials most rapidly. "Brite-Shot" gives the most peening action of all types of abrasives and its high ricochet properties increase its value in blasting inaccessible areas.

Almost everyone of these abrasives is available in many mesh sizes ranging from coarse similar to lake sand to finer than face powder. But for different conditions and results, a selected mesh of a selected type of abrasive is only one of the many variables which must be considered. Other variables are air presssure, gun distance, gun angle, amount of abrasive used, etc.

Conclusion

Many working advantages of V-B have already been mentioned and explained. But let's look at a few actual facts about the time and money savings resulting from using this process. A railroad shop has cut the cost of cleaning diesel locomotive pistons from $1.24 each to 25¢ by reducing labor 80%. One engine manufacturer has reduced the time for deburring and cleaning of fuel injector tips to ⅛ the original time.

Another diesel railroad maintenance shop reports that by use of this process, cleaning and maintenance costs were reduced 92.7% over previous methods. One large manufacturer of small high speed diesels is now able to make dies which produce 90,000 pieces between redressings instead of the 35,000 previously possible.

But railroads and engine manufacturers aren't the only ones saving money with V-B. The P.I.E., one of the leading transcontinental motor freight carriers, has reduced cleaning time of pistons and sleeves from 14 hours to one hour. Many truck and bus repair shops have had similar experiences.

These plus other benefits make this machine a very handy and desirable tool which can and has payed for itself in a short time just by the savings obtained through its use.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 101 to check them.

1. "The Highway Act of 1956" provides for building of highways totaling approximately:
   a. 20,000 miles costing about $15-billion.
   b. 40,000 miles costing about $27-billion.
   c. 60,000 miles costing about $45-billion.

2. Maintenance practices on diesel equipment used by road-building contractors are usually the same as those followed in trucking, power plants, railroads, etc.
   a. True b. False

3. Lube oil and filter change periods for diesels powering construction equipment are usually set according to:
   a. The make of engine used.
   b. Type of construction equipment on which the engine is used.
   c. Type of work a piece of equipment is doing.

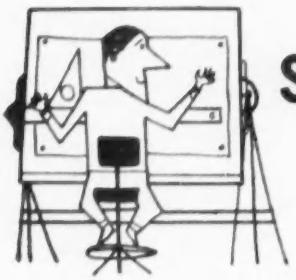
4. A field shop should be set up near a construction job site to rebuild engines completely, including crankshaft grinding, line boring bearing saddles, surface grinding cylinder heads and other precision work.
   a. True b. False

5. In construction work, the time for engine teardown and rebuilding is most frequently determined by the:
   a. Engine manufacturer's recommendation.
   b. Number of hours of operation.
   c. Specific engine's symptoms.

6. The most accurate way of getting precision fitting of piston pins as well as correct rod alignment is by:
   a. Reaming the con rod bushing.
   b. Honing the con rod bushing.
   c. Boring the con rod bushing.

7. When converting from gasoline engine drive to diesel, the radiator is one of the few items that need not be changed if the diesel has the same rating as the gasoline engine.
   a. True b. False

8. The principle of sandblasting can be applied to permit cleaning of deposits from pistons, valves, etc., without harmful metal removal or damage to precision parts.
   a. True b. False



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

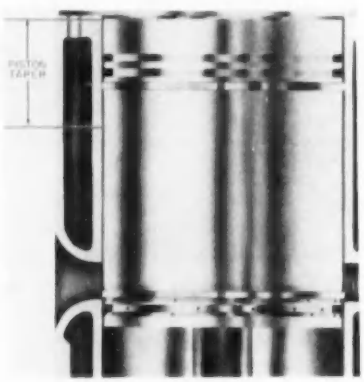
EMD Model 567C Engine Pistons

A design improvement incorporated in pistons used in model 567C engines since December, 1954, and available at all EMD parts warehouses, provides a reduced diameter, referred to as a relief at the bottom of the third compression ring. From this point the piston tapers out until nominal piston diameter is re-established, approximately 1-¼″ below the third compression ring groove.

This relief permits better lubrication between the piston and the cylinder liner wall at a point on the piston where oil film is important to satisfactory piston operation and compression ring life.

Pistons with the taper can be identified by placing a straight edge along the side of the piston and noting the clearance just below the compression rings.

All pistons for use in "C" engines will have the taper applied any time they are received at an EMD Factory Branch for inspection and relubrizing.



Caterpillar Double-Head Cotter Pins

Connecting rod bearing inspection is a routine part of engine reconditioning. To make connecting rod bearing inspection easier, large inspection openings are provided in the lower section of the cylinder blocks of all Caterpillar diesel engines.

Most mechanics agree that even with the large inspection openings, the most difficult part of connecting rod bearing inspection is cotter pin removal. However, the use of double head cotter pins in the rod bolts and castellated nuts of all Caterpillar diesel engines has made connecting rod bearing removal much easier.

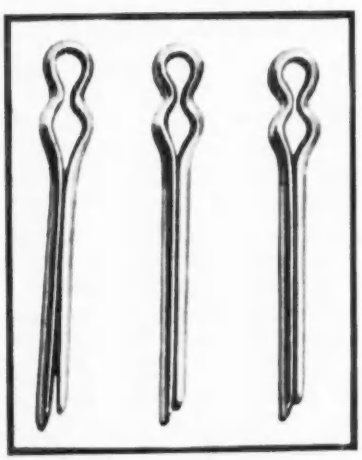
Correct assembly of cotter pins is also beneficial. They should be installed with the heads facing the inspection openings.

Double head cotter pins are also used in the main bearing cap bolts of D364, D375, D386, and D397 engines to facilitate main bearing inspection.

Three sizes of double head cotter pins are available at the parts counter. They are:

Part Number	*Size*
6F3465	3/32″ diameter, 1″ long
6F5264	1/8″ diameter, 1¼″ long
7F2002	1/8″ diameter, 2″ long

The use of the double head cotter pin is not restricted to connecting rod or main bearing bolts. Possibly you may find them highly advantageous in other places where pin removal or installation has been difficult.



Preventative Maintenance: Condition versus Mileage

by E. B. Ogden, Consolidated Freightways, Inc.
[S. A. E. Paper Number 652]

Is your PM system based on mileage, or on condition?

Here's the way one maintenance man feels about it.

WHEN do you start working on your engine? Up until three or four years ago, we felt it best to set a mileage limit when engines, transmissions, etc. were removed for overhaul, regardless of condition.

This is the customary practice, but it got a little too rich for our truck maintenance. I believe that somewhere along the line we confused the real concept of preventative maintenance with a schedule of automatic replacement and overhaul.

A "Preventative Maintenance Program" to me means that in addition to routine servicing we must set up a system to prevent unit failures. We inspect all units at predetermined mileages, and pick out the ones that will cause trouble before the next scheduled inspection. The others are continued in service.

This system will show results *only* if an adequate inspection, using good instrumentation, is applied. This means compression checks, crankcase pressure checks, used oil analysis, etc. Without these it won't work.

Responsibility for spotting potential failure is squarely on the inspector. If these operations are performed by well-trained, adequately-equipped personnel, I am confident the results will be more economical. Here's why.

If each unit were identical at the start, and received the same treatment under identical conditions, we could make a guess at when they would be due for a failure. But as this isn't the case, we are trying to out-guess a piece of machinery.

Until a few years ago, I advocated a top-mileage limit for unit overhaul or replacement. Along about 1951, I began to have doubts. Beginning with engines, I set out to either prove or disprove my suspicions.

For the most part, our engine failures had been occurring before the mileage limits had been reached. The majority, of course, ran as anticipated.

Upon dismantling this latter engine group, inspection did not generally indicate these vehicles were potential "tow-bar customers". They had many good miles left in them. This added to my suspicion that we were not completely correct in our methods.

Then, a strike in one of the engine plants shut off our replacement parts. We were forced to run our engines as long as they checked out on our PM inspection, regardless of mileage.

We found that many engines performed satisfactorily 60- to 80-thousand miles beyond the limit we had established as safe. For the most part, our PM inspectors were successful in detecting the bad ones.

Look at these percentages. Engine road-failures decreased 45% in 1954 over 1952. At the same time our average mileage between overhauls increased by 33%.

Here I will be questioned. How could we increase the miles per engine; yet cut the number of road failures? Here's what we found.

Many engines that failed were low-mileage-since-overhaul engines. We accredit this to minor mechanical mismating (before new parts wear in), poor assembly, or poor break-in. Thus, the fewer overhauls we did, the less the opportunity for failure. Once an engine gets over this critical period, a long, useful life can be anticipated.

To demonstrate the scope of the testing, in 1952 we operated 49-million power miles; 60-million in 1954. I think the record speaks for itself.

We were equally successful on other components. Removing top-limits showed a 45% increase in transmission life; and up to 38% increase with differentials.

No doubt some will disagree with my maintenance ideas. But the fact remains that in many cases the difference between profit and loss is found in the cost of equipment maintenance. Any program that doesn't secure utmost mileage, with only reasonable road failures, should be inspected critically. There is a delicate balance between under-maintenance and over-maintenance.

In closing, I want to plant a seed for thought. As long as a piece of equipment is operating happily, why not let it enjoy itself? It will usually start groaning well enough ahead of a break-down to allow scheduling an appointment with a mechanic. All you need is a good inspector to make the appointment.

Largest Bottom-Dump Hopper Trailer

Diesel-engined tractor-trailer has the capacity of a railroad hopper car. It carries coal down inaccessible mountain roads to a tipple in the valley.

"WORLD'S largest bottom-dump hopper trailer" is how Marion Metal Products Co. describe their latest unit. The matched tractor, made by Kenworth, is powered by a Cummins diesel engine.

This big unit is the result of the search for more efficient and economical production in the coal fields. The diesel-powered rig enables more coal to be transported over rough country at less cost per ton-mile. Fifty-ton hopper trailers are already in use in many operations.

Before long, this 70-ton trailer will be hauling coal from open seams high on the mountains of West Virginia to a tipple located up to seven miles downhill. From these loading hoppers the coal will be dropped into rail cars. The truck will then return, empty, up the mountain for another load.

When the loaded trailer arrives at its destination, hopper doors are opened by gravity. Closing of the two drop-doors is controlled by a 10-in air cylinder with a 24-in stroke. Controls are mounted on the left side of the trailer.

Rated 75-cu yd at struck (water) level, the trailer will actually carry well over 100-cu yd when heaped. When loaded, the total weight is nearly 120-ton.

Part of this tonnage will be supported by the trailer axle, manufactured by Kenworth. It is a 10½-in solid, square billet turned down to 8-in at the ends. Yield strength is 55,000-psi, ultimate strength 85,000 pounds per square inch. Rated capacity of the axle is 100,000-pounds. It is protected by a steel shield on the rear of the trailer.

Front springs of the tractor are variable rate. That is, in addition to being rubber mounted at the ends they have steel seats set next to the rubber. When loaded, it shortens their effective length. Unloaded, the truck rides on rubber.

Rear axle capacity is 95,000-lb. It is full-floating double-reduction, constructed from high-strength cast steel.

The tractor was designed and built for the trailer by Kenworth. A Cummins diesel engine, model NHV-1200 supplies the motive power.

This engine has a 5⅛-in bore by a 6-in stroke. It is vee-type, 12-cyl, 4-cycle and normally-aspirated. Horsepower is rated 400, continuous, at 2100-rpm. Power is driven through a torque converter supplied by Twin Disc. To this unit, is coupled a Fuller 4MS-1440 transmission. Road speed is up to 34-mph.

Throughout the design, a high degree of interchangeability was sought. All tires and wheels are the same size (13.00 x 33-in). They measure nearly six foot in diameter. All main wheel-bearings are 8-in inside and 12½-in outside diameter. This interchangeability has also been carried over into the brake system.

As would be expected, the brakes are unusually large and powered by air. Each wheel has eight similar brake shoes, each 10-in wide, set around a 26-in diameter.

In spite of its size, the tractor retains the advantages of a two-axle, single-axle drive truck, including a shorter turning radius and less chassis weight. In addition, it combines the size of a railroad car with the economy and mobility of a diesel engined truck.

Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Torque Heads Properly

Robert Nuezil, Fallbrook, California—I don't quite agree with the article on "Torquing Hard-to-get-at Head Nuts" in the August "Tool Box". Don't you think you made a little slip, and that if a job is worth doing it is worth doing right?

I've found that tightening head bolts to specified torque one at a time in recommended order leaves the first few bolts loose. I always bring bolts to torque a little at a time, and check each one twice at the finish.

Also, after the engine has operated a while, the head bolts seem to loosen up again. If it is worth checking these bolts at all, it is worth taking off the rocker arms to tighten them properly. I've found that some of the bolts are nearly correct; while others are quite a bit off.

Another thing. If the head is disturbed it will sometimes change the valve clearances. These should be checked to do a good job. It is these fine points that give top engine performance and long life.

I think Mr. Allen has a good point only if it is impossible to use a torque wrench. What do you think? *We think in general you're right. We certainly should have mentioned gradual tightening and a final check.*

Incidentally, the principle of tightening a bolt by counting the turns is an accepted idea. This "micrometer" technique, producing a definite elongation, is very accurate. It pre-tensions the bolt to the desired specification, and has the advantage of eliminating the element of friction on the threads and under the nut. In the engineering department, the desired pre-tension and resultant elongation can be figured. Mr. Allen is figuring backwards from a torque wrench value that has been previously figured to produce this pre-tension.

Resurfacing Cylinder Heads

Peter Baker, Denver, Colorado—"Talking Shops" last month was another of a good series; but every once in a while I see something that I don't agree with. This time I decided to tell you about it.

One part of the article said that all cylinder heads are ground automatically without checking to see if they need it. You added that filling the bumps and hollows by pulling down the head is asking for trouble. I don't agree with you all the way.

If you have the engine in the shop for complete rebuild, then I agree. But if you are making an in-service repair, then I think you are wrong.

A warp of a few thousandths, even though it isn't absolutely correct, can be tolerated. It is a lot easier to use it this way on a field-repair, and it won't make that much difference. Naturally, if the surface is rough at vertical siding areas, clean up is necessary.

Of course whenever you shave even a few thousandths off a head, you have to do other things, too. First, you've changed the protrusion of the injector tip, so that it is sticking out too far into the cylinder. If the engine uses injector sleeves, you may even have to change the sleeves. Second, as long as you have the head off, you will probably grind the valves. Shaving the head may alter the valve-seat area. By the time you grind the seats and reface the valves, you may run into too much stem protrusion. This lowers the tension of the valve springs, and you have to put spacers under them to bring them back.

With these things in mind, we tolerate minor warping of a few thousandths. It doesn't require too much torquing on the studs to straighten out the head.

Under field conditions you can get away with a lot; it is a matter of degree and sound judgment. Commenting on this subject in a recent Automotive Engine Rebuilders Association bulletin, their technical Committee set a maximum limit on warping before surface grinding was necessary at 0.006-in. The manufacturers recommendations are the final words. Straightening a warped head by torquing leads to uneven pressures and internal strains that can lead to cracking.—Editor

Municipal Power Plant Relies on Young Coolers

Young Horizontal Core Radiators cool jacket water serving the 3 power plant engines.

Fairbanks-Morse 960-H8 O-P Dual-Fuel engines supply power and light to Brackenridge, Pa.

Young "HC"® Units
Cool Dual-Fuel Engines

Another example of Young-preference when it comes to *dependable performance required!* When Brackenridge, Pa., built its own power plant rather than buy from expensive and impractical outside sources, this community wisely specified dual-fuel engines cooled by Young radiators. Effective and efficient use of fuels, gas and oil, enables the power plant to operate with sizeable savings to Brackenridge.

Young HC Horizontal Core units are available for water, oil, gas cooling and steam and vapor condensing in any combination. HC features include, (1) low speed fan gives high efficiency performance at minimum horsepower requirements and low operating cost, (2) vertical air discharge provides even air distribution—eliminates air recirculation and effects of cross winds, (3) compact Young design permits space-saving, in-line installations of 2 or more units for additional capacities and services. Young HC units combine *efficiency, economy, versatility.*

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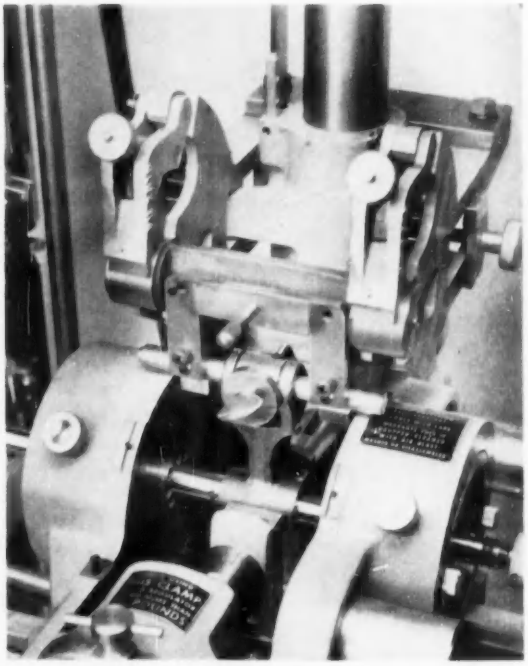
Precision-Fitting of Piston Pins

(Continued from page 55)



Various attachments can be used on Tobin-Arp machine for boring engine parts of different shapes. This jig is used for holding one end of a cam rocker lever while boring bushing in other end.

According to the manufacturer, the complete time required for a six-cylinder rod set should not exceed ten minutes, including set up time and all.

Incidentally, the operator is never called upon to use a pair of pliers or a wrench. Everything manual is done by air. Consequently, everything is done exactly the same each time, and the strength of the operator has no influence over the accuracy of the work.

Other Uses

Piston pin fitting is not the only thing you can do with this piece of equipment. It will bore rocker-arm bushings with the same precision, and equipment has been developed with which it is possible to bore cam follower bushings.

In the latter operation, the machine maintains absolute parallel between the center-line of the bushing and the center-line of the roller shaft.

Conclusion

Precision engines require precision fittings. Aside from that, there is the element of time. Modern equipment does the job faster as well as better.

Tobin-Arp have conducted comparative time studies between their pin fitting machine, and hones and reamers. They found that boring piston pin holes where new bushings had been installed took them less than 50% the time required with honing or reaming operations.

They are just as strong in stressing, however, that the speed of the fitting in no way detracts from the quality.

news of our industry

Field-Modified Tournatractor

A custom-built boom installed on this model C Tournatractor greatly broadened the machine's usefulness to the Indianapolis Power & Light Co.

When the boom is folded back out of the way, the machine is free to handle its normal work—dozing and push-loading coal scrapers. The boom is built to function without hampering the dozer blade; but it allows the machine to do "extra" jobs.

One of these is unloading 3000-lb cylinders of chlorine from railroad flat cars. Used for water purification, these shipments were infrequent, and didn't justify a special crane. Now, instead of bringing in special equipment, a single Tournatractor handles the "extra".

Diesel Conversion "Dinkie"

A 102-hp Detroit Diesel diesel engine has replaced a gasoline engine (and mounted in the same frame) in this 8-ton Plymouth yard locomotive. Today it's doing a giant's work for Julius Porath & Son Company, concrete suppliers.

The "dinkie" handles as many as twelve cars at a time, shuttling incoming shipments of gravel from a siding to the ready-mix plant.

Power is transmitted through an Allison Torqmatic converter, providing the smoothness of steam in starting heavy loads as well as torque multiplication.

"High-Altitude" Locomotive

Alco has received an order for six "World" diesel-electric locomotives from Southern & Central Railway of Peru—the highest standard gauge railroad in the world. The 1800-hp DL500's will be operating over the Andes at elevations up to 14,666-ft.

In addition to hauling wheat inland, the locomotives will bring heavy mineral trains back to the coast. For this kind of hauling, two pieces of equipment were specified.

Turbochargers were needed to take trains up high-altitude grades; and Dynamic Braking to provide a margin of safety while bringing them down.

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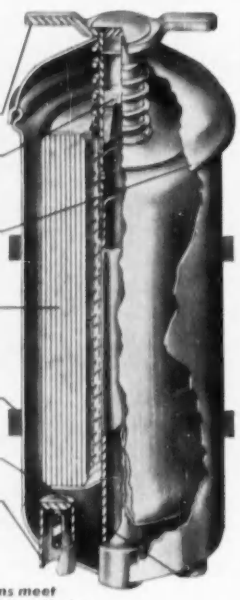
- Functional "O" ring seal—The greater the pressure, the greater the seal. Eliminates constant gasket replacement.
- Elements are designed to give a maximum of filtration, accomplished by the use of perfected filtering media in relation to service requirements.
- Sturdy clamp-type mounting for safe installation under all conditions.
- Drain is located at the bottom of oil sump.
- Inlet at bottom for ease and safety of installation. Inlet check valve prevents drainback and undesirable turbulence.



Over-all dimensions meet truck or industrial installation requirements.

FULL FLOW FILTRATION

Oil conditioning and full flow protection to all precision working parts of the engine are incorporated in the same unit. Cases are designed so that new elements may be replaced in a matter of moments.

Request complete catalog listing all sizes and capacities of Engine Life Filter Cases.

A complete line of filters and replacement elements

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EL MONTE, CALIFORNIA

ENGINEERED FILTRATION SERVICE

INDUSTRIAL AUTOMOTIVE MARINE & AGRICULTURAL

Maintenance Tips

(Continued from page 63)

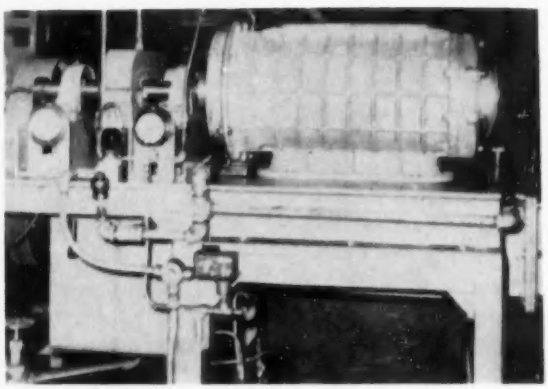
Turbocharger Tester

This stand is used to simulate actual working conditions. After an overhauled blower is placed on stand, its drive shaft is coupled to test stand drive shaft. Oil piping is connected to the bearings, and the exhaust is piped to a fabricated plenum chamber.

A DC drive motor, with six-step speed control, permits smooth acceleration up to 1,000 rpm. It is held here for 5 minutes. Then the speed is increased to 1,200 rpm, and progressively increased to 1,400, 1,600, and 1,800-rpm. A total of 5 minutes is held at each speed range.

At the top speed of 2,000-rpm, the blower is operated for another 5 minutes, maintaining a manifold pressure of 6 to 8-in of mercury. A motor driven oil pump maintains a 65-psi oil pressure to the bearings throughout.

This test has proven effective in detecting unbalance or defective bearings which might have resulted in a bearing failure on line-of-road.



Cylinder Head Test Rack

This rack was designed for water leak testing of ALCO and EMD cylinder heads.

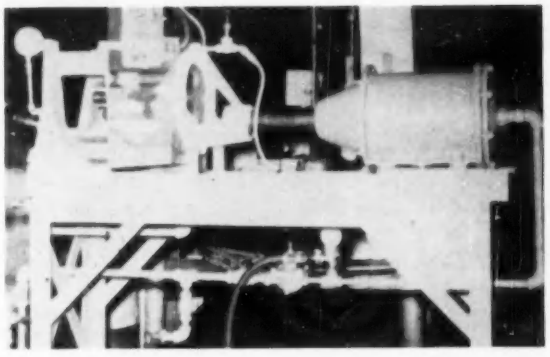
As an ALCO head is placed in a fixture, a locating pin matches a stud hole in the head. This lines up the cooling water inlet and outlet openings with water and drain connections on the fixture.

For testing EMD type "B" cylinder heads, a ring with appropriate pressure-pads, water, and drain connections is placed around the head. For testing EMD type "C" cylinder heads (due to the different design of water discharge openings) only a small plate with valves and drain connection is used. It is secured by two cap screws.

After a head is placed in the fixture, it is held by a safety clamp. Air pressure is applied to the holding cylinder, and the piston rod comes out to hold the head securely against

the fixture. Clamp is then removed. This fixture carries hole-sealing gaskets, bleeder pipe and valve.

As water from a shop line is turned on, a bleeder cock is left open until all of the air is vented from head. Then the full water-pressure of 90-psi is applied for 15 minutes. A visual inspection is made for leaks.



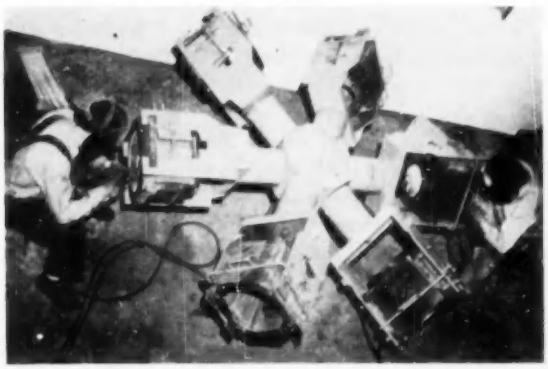
Welding Clamping Fixture

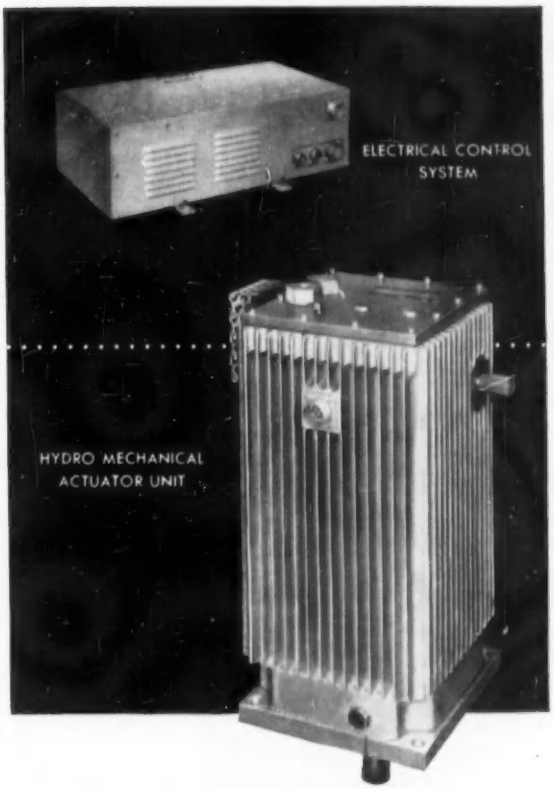
This positions a revolving stand with horizontal columns. Each supporting column and its clamping fixture is equipped with roller bearings, so that the boxes can be turned easily. This places them in the most convenient position for the operator.

Normal procedure is to apply only a few beads of weld at a time, and then turn the stand to another position. This practice avoids excessive heating or warping. Welding is continued progressively from one box to another until the work on all six boxes is completed.

After worn surfaces are built up, the boxes are rebored to a rough finish standard dimension on a vertical turret lathe. Enough metal is left for finish grinding on a micro grinder.

After excessively-worn outside surfaces are built up by welding, the boxes are placed on a special jig. This holds four boxes at a time. It planer-finish machines to standard dimension.





ADVANCED . . .

The Westinghouse electric governor features isochronous paralleling of two or more units

Automatic isochronous load sharing by two or more engine-generator sets is now possible with the new Westinghouse electric governor. Combined set operation has the same precise performance as during separate unit operation.

Governor has no electronic tubes, works on zero speed regulation. Up to five per cent adjustable speed regulation is available for conventional parallel operations.

Suitable for diesel and gasoline engine-driven generator sets from 30 kw through the largest sizes; 50/60 cps or 400 cps. Designs available to meet full military environmental requirements. For complete details send coupon below. J-21966

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new products

Diesel Head Reconditioning Kits

Salsbury Corporation has introduced three new Diesel Engine Reconditioning Kits. The trio was developed especially for repairing cracked cylinder heads on Cummins and GM diesel engines.

Original production was in a limited quantity, and intended only for experimental use. They are now produced in greater quantity, and designed to recondition all Cummins NH and HB series heads, as well as GM series 71 and 110 diesel heads.

According to the manufacturer, users report trouble-free service on reconditioned heads, in many cases obtaining a road-life in accord with the normal span of a new head.

Instant Water-Demineralizer

Crystal Research Laboratories has been issued a patent covering a method of instantly demineralizing tap water. The name for this device is "Deemajet".

This unit is fully portable, and it attaches to any faucet or tap. It consists of a one-gallon polyethylene container filled with ion-exchange resins. The manufacturer states that only deionized water can pass through the filter, since the mineral salts are trapped by the resins. When the filter element becomes exhausted it changes color, and a new one can be substituted in its place.

Deemajet is now being used in the storage battery field, and is expanding into areas where a supply of demineralized water is desired. A ready source of mineral-free water introduces possibilities for the treatment of vehicular cooling-water systems. Starting with demineralized water could well give a head-start to a water conditioning program.

Five New Internal-Gear Rotary Pump Series

The Industrial Div. of Wayne Pump Co. has announced five new positive-displacement-pump series. The Manufacturer stated that the new series was brought about because of a definite need by industry.

All five include Wayne's circular tooth design in their rotors and idlers. This feature is said to provide rolling contact and smoother engagement of teeth. This results in higher volumetric efficiency.

Series "A" (medium viscosity) ranges from 3 to over 100-gpm, maximum speeds of 650 and 1800-rpm, pressures up to 125-psi. Series "B" is similar, but approved to handle hazardous liquids. Series "C" (heavy-duty) consists of 650-rpm, maximum capacity over 300-gpm pumps. Series "D" handles highly-volatile substances up to 100-gpm. Series "E" handles medium to high-viscosity materials requiring a heated circuit and pump.

All can be supplied in a variety of applications.

DON'T ROD OUT SCALE

—Dissolve It!

OAKITE COMPOUND No. 32 did all the work on this pipe—did it better, faster, far more safely than any mechanical method.

Oakite Compound No. 32 *dissolves* scale and rust as it circulates—often makes dismantling of equipment unnecessary. Removes *all* deposits—flows into areas inaccessible to rod and drill. Does not affect sound metal surfaces—does not change dimensions of tubes and piping.

Use Oakite Compound No. 32 to descale and derust

condensers	heaters
compressors	brine coolers

FREE HANDBOOK tells all about it. Ask your local Oakite Technical Service Representative. Or write Oakite Products, Inc., 22C Rector St., New York 6, N. Y.

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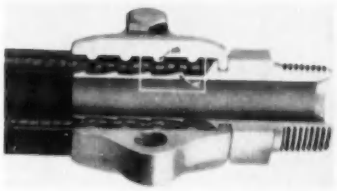
new products

Locking Hose Clamp

A new inter-lock clamp has been introduced by Eastman Mfg Co. It features a grip obtained by positive-positioning of machined insert and clamp.

The accurate location of the clamp over the insert assures alternate mating of the barbs of the insert (A) with the ribs of the clamp (B) clamps are available up to 4-in hose diameter, and for pressures up to 5000-psi.



Alco's Hi-Qua-Led Steel

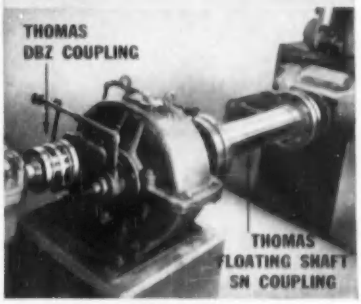
Alco has announced a new leaded steel that greatly reduces machine tooling costs. Time saved was claimed up to 71% on lathe operations, up to 50% on tooth cutting, and decreased tool wear ranged up to 94%.

Reinforced Flex Tubing

Bardex, a flex industrial tubing, has been introduced by Newage International. It is a tensile spring reinforced-plastic piping, claimed to be uncrushable.

The spring is encircled on either side with plastic. Chemically inert, Bardex is resistant to petroleum fuels, coal and butane gases, and dilute acids. It has a working temperature range of 5° to 170° F. Pressure range is from 100 to 200 psi. It is available with standard fittings.

Freedom From Coupling Maintenance



Install Thomas Flexible Couplings

First cost is *only* cost when you buy Thomas Flexible Couplings . . . because Thomas Flexible Couplings are correctly engineered . . . have no wearing parts . . . need no lubrication . . . eliminate future maintenance costs. Even more, Thomas all-metal couplings are open for inspection while running—ending inspection shut-downs!

For all practical purposes, properly installed and operated within rated conditions, Thomas Flexible Couplings will last forever.

NO LUBRICATION . . .
NO MAINTENANCE . . .
There Are No Wearing Parts

Under load and misalignment, only Thomas Flexible Couplings offer all these advantages:

1. Freedom from backlash—torsional rigidity
2. Free end float
3. Smooth, continuous drive with constant rotational velocity
4. Visual inspection while operating
5. Original balance for life

Write for Engineering Catalog 51A

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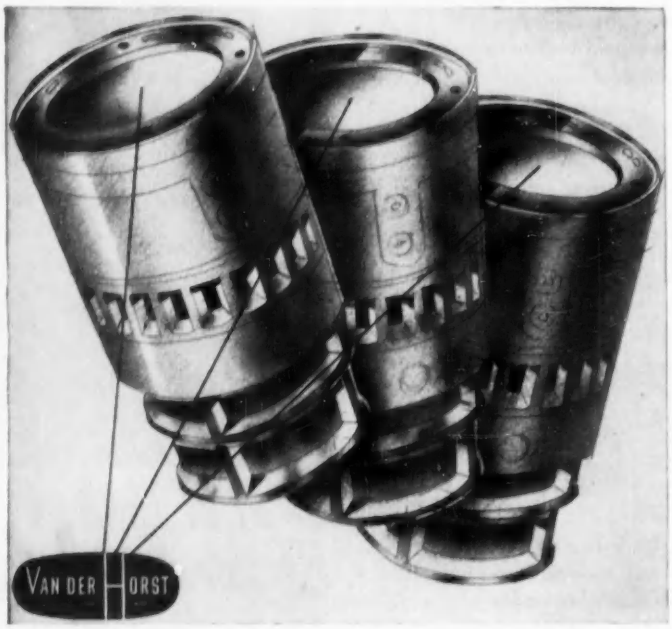
5 *big advantages of*



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news of our industry

Le Roi Expansion

Le Roi Division of Westinghouse Air Brake Company will spend $5½ million in the next five years to expand engineering and research facilities.

ARBA Convention Theme

The major theme of the 1957 American Road Builders Association Convention in Chicago will be methods and techniques to boost productivity. This includes not only in highway departments; but also out on the job.

The Federal Highway Act makes it important for every operator to get the most from what he has, and to be aware of new developments.

Light-Weight Dromedary

Pacific Intermountain Express is getting greater pay-loads and increased capacity from the cab-forward-of-engine Kenworth XD-30.

Extensive use of aluminum has reduced truck weight. Dry weight of the new unit is 500-lb less than P-I-E's conventional droms.

Twenty are now in service on company routes.

"No Bidding Without Tools"

Contractors bidding on work in Manitoba's (Canada) $27 million highway program have been warned not to take on a job unless they have men and equipment to finish it on schedule.

If they contract for more work than their facilities permit, the Public Works Department will insist they make good on their bond.

From now on, if the department does what it says, the only reason for not finishing on time will be uncontrollable circumstances. Otherwise contractors will be penalized.

Maybe this is a hint to examine your equipment, to see if you have enough of it, and that it's delivering its full potential.

news of our industry

Shipping Information

For over a year, Pacific Intermountains Express has had an unusual service—they supply a lot of information.

Known as "T I B" (Traffic Information Bureau), the bureau answers hundreds of requests on shipping rates.

The number of requests testifies to the mounting importance of shipping costs.

"Good Maintenance or Bad—the Difference is Profit"

This theme will highlight the 1957 Plant Maintenance and Engineering Show in Cleveland.

The number of companies exhibiting is expected to exceed 400, with about 5000 pieces of equipment and products.

Oil-Well Drilling Fluid

A new class of oil-well drilling fluids that will help to open up oil reservoirs too deep to be reached by conventional drilling methods has been developed by Socony Mobil.

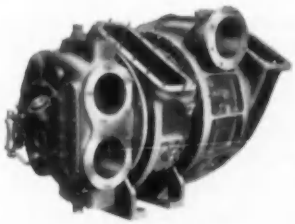
One type of fluid, referred to as a calcium-surfactant mud, was successfully used last Spring in completing the world's deepest well—the 22,570-ft wildcat in South Louisiana.

New Purolator Technical Service

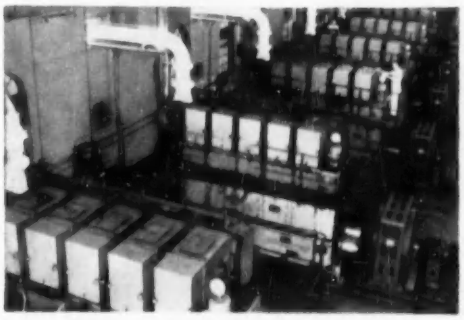
Creation of a new department and the appointment of a new Chief Engineer has been announced by Purolator Products.

The new Service Department, to be headed by H. R. Otto, is designed to provide fast field sales engineering service to Purolator's accounts in the field.

This is noteworthy because it represents a step in the right direction. It results in closer liaison between the manufacturer and the user, and is an important step toward supplying the user with service information.



'English Electric' chose Napier Turbo-blowers



for these alternator sets

By courtesy N.S.W. Government Tourist Bureau

which power this city

The seven 'English Electric' 5SRL Diesel alternator sets installed in the civic power station at Newcastle, N.S.W., Australia, are each fitted with a Napier TS 300 turbo-blower. The power station supplies the whole of the city's power requirements.

Why did 'English Electric' choose *Napier* blowers? Here are three good reasons:

- Napier blowers have *high adiabatic efficiency* resulting in low fuel consumption and maximum power increase.
- Napier blowers are backed by a world-wide service and spares organisation.
- A high standard of workmanship is guaranteed by Napier's long experience in the design and manufacture of aircraft engines and gas turbine machinery.

Napier turbo-blowers are available in seven sizes for engines of 140-5,000 h.p. afloat and ashore. Multiple installations for engines of higher powers. On 4-stroke Diesels they can double the power, on 2-stroke they increase it by over 30%—often at a lower specific fuel consumption. Napier turbo-blowers are currently in service in 69 countries.

NAPIER Turbo-blowers

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GBG T12

news of our industry

Battery Merger

Exide Batteries of Canada and Willard Storage Battery of Canada have merged. The name is now Electric Storage Battery Company (Canada) Ltd.

Both companies were subsidiaries of Electric Storage Battery Company of Philadelphia.

Plant Operator Course

A Diesel Plant Engineers' and Operators' Short Course is planned at the University of Illinois for October 30 through November 2. This program is planned for the practical operators of diesel plants.

The conference committee is anxious to determine how many would be interested in attending, and a card insures a printed program and a reservation blank.

Truck Driver "Fraternity"

Within the past 6½-yrs. since intensive training courses in truck driving were inaugurated by North Carolina State College in 1949, over 1600 students have completed the course.

"Things to Come" Dept.

Alcoa has developed a wear-resistant coat-of-metal idea, which, when applied thinner than a sheet of paper, will remove a major block to the development of America's first all-aluminum diesel engine.

The possibility of a highly wear-resistant coating of sprayed steel on cylinder walls opens new horizons to the design engineers of tomorrow.

GM Free-Piston Engine

After 25,000-hr of testing, the GM-14 free-piston engine (gasifier) received a vote of confidence from GM Research Staff Engineers.

Rated power output has been increased by 25%, and the life of all critical parts has been extended.

Engineers rate the gasifier as a future contender in the commercial power field.

Turbocharged Air-Cooled Diesel

Kloeckner - Humboldt - Deutz, AG has completed an air-cooled turbocharged diesel engine.

Two models are available: an 8-cyl automotive engine rated 210-hp bare; and a 12-cyl engine rated 310-hp bare. The bare rating includes the cooling blower.

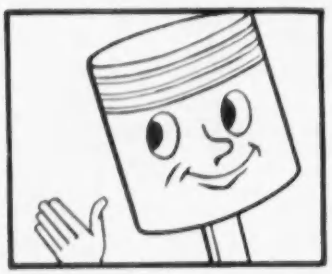
Diesel Conversion

Nighthawk Freight Service of Chicago has completed a 10 tractor "Turbodiesel" repowering program.

"The purpose of this program was to modernize these units with engines that develop more power, and at the same time increase the mileage per gallon of fuel consumed", stated President N. P. Brodarick.

The diesels, which replaced gasoline engines, have increased fuel mileage at least 47%.

STARTS AND STOPS
. . . sure and safe



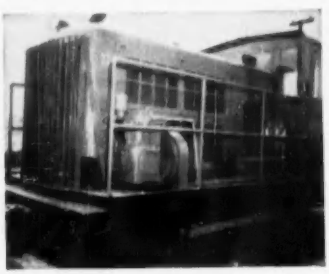
By Cecil Diesel
ROVING REPORTER

KANKAKEE, ILL.—A power shovel dumps the final load of rumbling stone into the last car. The train is loaded. A shout from the rear, then the International UD-1091 diesel

hums louder. The locomotive eases the train to a roll . . . hauls the heavy load of stone on a quick trip from quarry to crusher . . . brakes to a steady, sure stop.

I ask the engineer, "How'd you start and stop so smooth with that heavy load?"

"Easy," he says. "Compressed air operates sander and brakes — and this air is furnished by a QUINCY Compressor." Lehigh Stone Company has found it can rely on its

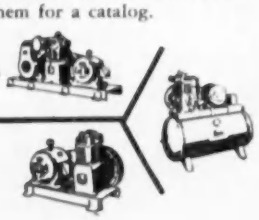


Model 340 Quincy Compressor . . . for a supply of air that's always there.

And there's a Quincy Compressor to fit every diesel requirement — including horn blowing and engine starting. Let Quincy help you select the right model from a range of mountings and sizes — from 1 to 90 CFM. Write them for a catalog.

Quincy COMPRESSORS

QUINCY COMPRESSOR CO.
DEPT. J-51, QUINCY, ILLINOIS



World's finest air compressors

news of our industry

Noise Symposium

The growing problem of noise, and how to live with it or silence it, will be discussed at the National Noise Abatement Symposium in Chicago. Fourteen papers will deal with quieting machinery and industrial plants.

Mack's in the North

Defense Department officials were shown a film taken by Mack, showing a convoy of 161-ton GVW Mack trucks operating in the roadless, arctic wastes.

The 1200-mi journey opens a new transportation potential in the far-north, and demonstrates what a diesel can do.

Mighty Mite

Driven by a Waukesha gas-engine, this National supply F-60-SS triplex pump feeds five input wells on an oil field flooding project.

Although a midget beside the usual pumps found in the oil fields, it is keeping several pumping units busy by flooding the oil-bearing sands with water.

Cross-Channel Express

An accelerated inter-capital train service has been established between London and Paris. In connection with this route, French Railways have introduced a crack, new diesel Autorail.

Addition costs for this service, including a reserved seat, are less than one dollar.

Diesels operate very cheaply.

"Package Program" for Overseas

An internationally - coordinated audio-visual "package program" is being offered to US manufacturers who are interested in developing European markets.

Designed especially for manufacturers of bulky or heavy equipment, the US produced program is translated overseas and shown to European customers.

REMOVE PARTS SAFELY WITH Snap-on PULLER TOOLS

Snap-on pullers handle a wide range of pulling jobs safely, easily, quickly — protect expensive wheels, gears and other parts from damage — save hours of labor time. *Snap-on* builds a complete line of pullers with pulling pressures ranging from a few pounds to over 50 tons. You handle the toughest pulling jobs without the smashing sledge blows and shocks which can ruin expensive machinery.

Interchangeable parts, special adapters

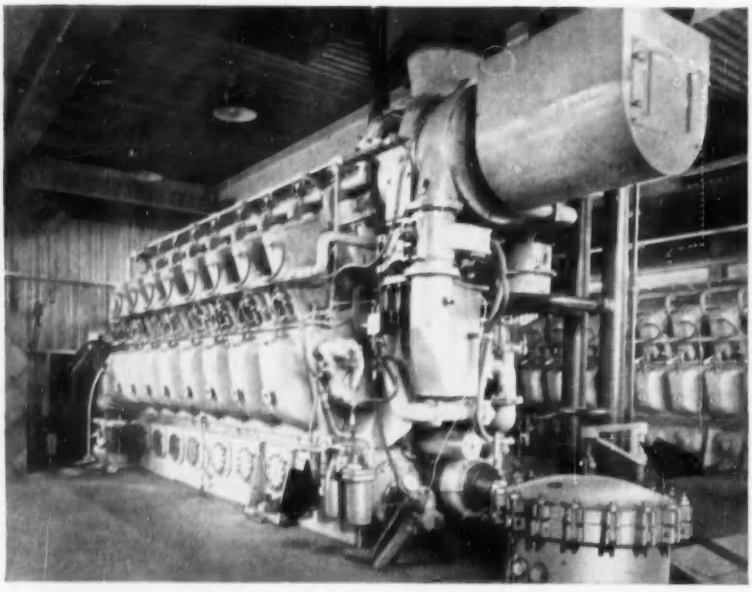
Snap-on makes special adapters, reversible jaws and interchangeable parts that permit you to use one basic puller set for many jobs. Jaw-type pullers are designed to lock on to the job — eliminate slipping and binding.

Snap-on offers a complete line of over 4,000 industrial and mechanics tools. Send for your copy of new *Snap-on* Catalog V now.

*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION

8064-J 28th Avenue • Kenosha, Wisconsin



NUGENT FILTERS

. . . the best protection any engine can have

Nugent Filters protect both lube and fuel oil for the Alco 251 Diesels installed at the Laton (Kansas) Pumping Station of the Service Pipe Line Company. This recently built pipeline conveys crude oil from Fort Laramie, Wyoming, to Freeman, Missouri.

To help guard against the serious consequences of a power failure, a Nugent #1555-4L12 filter provides the Alco Diesels with full flow filtering of lube oil. The filter cleans all the engine lube oil in circulation every cycle before going to the bearings, removing particles as small as 2 or 3 microns.

Fuel oil, too, receives the protection of Nugent filtering. A #1555-BF-1R Duplex Filter is mounted on the suction side of the fuel oil pump—protection for trouble-free injection.

You can prevent harmful impurities from reaching spots where they can accelerate wear, shorten engine life or cause power stoppage by employing Nugent Filters. They offer a choice of full flow or by-pass filtering with the same unit. Recharges are inexpensive and easy to change. Simple piping makes installation no problem.

Let Nugent show you how to insure long engine life—write for descriptive literature.

NUGENT TRADE MARK

Established 1897

Wm. W. Nugent & Co., Inc.

3426 Cleveland St. Skokie, Illinois

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

news of our industry

38th Birthday

September 12 was a big day in Racine, Wis. It was the day Twin Disc Clutch Co. dedicated its new plant (92,500-sq. ft. floor space).

Actually, the dedication became secondary to the honors paid P. H. Batten, founder of the company and now chairman of the board. It was also his 38th anniversary as active head of the company.

As "P. H." said at the time:

"They usually wait until a man is dead to pay homage to him; but I am sure enjoying this".

The occasion was highlighted by two talks by Governor Walter J. Kohler. He spoke of his long friendship with Mr. Batten, and outlined the plans of the State for creating an atmosphere healthy for industry. He, as well as the other speakers, made frequent reference to 38-years of cooperation between management and labor at Twin Disc.

"P. H." founded the company in 1918 for the purpose of building a farm-implement clutch in the early days of farm mechanization. Better highway building of the early '20's led to an expanded product line. Then the increasing use of internal combustion engines led to further expansion. Today, TD has a complete power take-off line.

new products

Air Filter-Drier

Briggs Filtration is marketing a filter that removes moisture, acids, and solid particles by means of mesh-size particles of activated alumina.

It is designed for applications where clean, dry air or gas is needed.

Electrical Joint Compound in Plastic Bottle

Alcoa #2 compound, which removes oxide film from aluminum or copper electrical conductors and fittings, is now packaged in a plastic squeeze bottle.

The new container holds 8-oz, and is oval in shape to prevent rolling. It is easy to carry and use on the job.

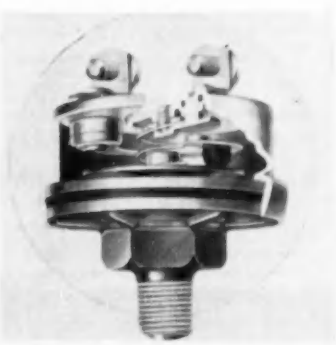
Electrical joints so treated are in the same range of contact resistance as silver-plated joints. May be used either aluminum to aluminum or copper to aluminum.

Heavy-Duty Vacuum Switch

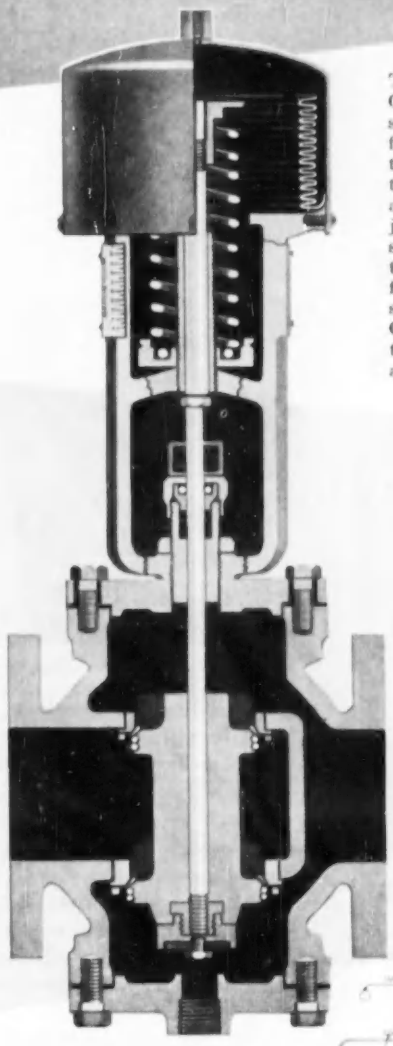
A new type vacuum switch, designed for a broad range of application, has been put into production by Rochester Mfg. Co.

Housed in a hermatically-sealed dust-proof steel case, the switch features a spring loaded diaphram, Buna-N-impregnated, protected against heavy vibration, pulsation and shock. Operation, which is factory calibrated, opens and closes a contact at fixed vacuum values.

Sample vacuum or pressure switches for examination and testing can be secured by writing.



NEW VALVE PROTECTS 3 WAYS
... STOPS GAS ENGINES QUICKLY



This new Sylphon Pressure-Operated Valve now makes possible faster, all-round protection for gas engines. Team it up with the Sylphon No. 530 Safety Control, and you can stop worrying about low lube pressure, high jacket water temperature, or overspeed. If any one exceeds the limit, this valve tightly seals off the fuel supply and vents the fuel system for immediate shut-down. On top of that, it is so versatile that you can plug the vent port and use it for many other services.

Special Sylphon® seamless bellows assures continuous valve operation. No seams to break and leak. In addition, it's made in two plies . . . easily withstands control air pressures up to 40 psi.

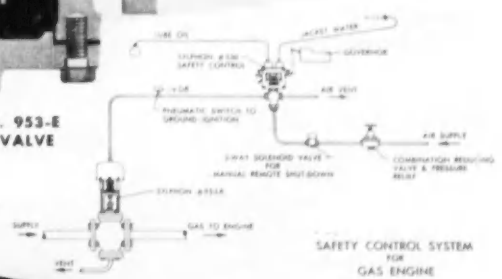
Pressure to open or close valve ports can be quickly adjusted simply by turning a disc below the spring. Clearly-marked scale shows adjustments at a glance.

Composition O-ring seals and renewable disc give "bubble-tight" sealing of both the main ports and the vent port.

Available in 2" and 3" valve sizes for air, gas, water or oil. Operating pressure can be as high as 65 psi. Bodies bronze or steel.

FULTON SYLPHON NO. 953-E
PRESSURE-OPERATED VALVE

SEND FOR
DATA SHEET TD-953-E



SAFETY CONTROL SYSTEM FOR GAS ENGINE

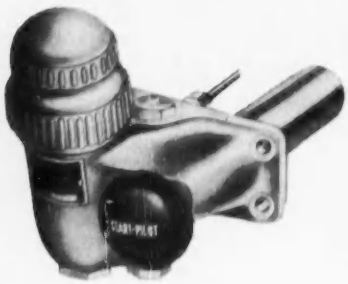
Mr. Controls

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.

START PILOT

FOR INSTANTANEOUS DIESEL STARTING



STARTS YOUR ENGINE AT MINUS 60°F.
SAVES UP TO 50% ENGINE WEAR

DESIGNED FOR

ALL TYPES OF

DIESEL ENGINES

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Please send me additional information on the START PILOT device and the START PILOT fluid.

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new products

"Midget" Valve Seat Grinder

The Kwik-Way "Midget" has been added to Cedar Rapids Engineering Co's line of valve seat grinders.

This model is especially adapted to grinding seats in small, air-cooled engines, and wheels as small as 1-in diameter, with 7/16-in holes, are provided. Power is sufficient to use larger wheels.

High-Visibility Slip Proofing

Heavy-Duty Grip is claimed to give positive traction on floors, stairs, ramps, or wherever applied. Available in aluminum shade, it also brightens darker places.

Heavy-Grip is said to stick to anything—metal, wood, concrete or glass. It can be used indoors or out, is immune to water, gasoline, oil, grease, solvents and fats. Sandpaper-like in texture, it is said to wear like metal.

It is applied with a trowel or any flat spreading tool, and dries overnight.

THERE'S NO SUBSTITUTE for LUBER-FINER'S ENGINEERED PROTECTION

YES! IT'S WHAT'S **INSIDE** THAT COUNTS
The Efficiency of Luber-finer's Exclusive Patented Process
HAS NEVER BEEN EQUALLED!

USE ONLY GENUINE

Luber-finer

DIESELPAKS

Only a Luber-finer Unit *Plus* a Genuine Luber-finer Pack can give the Exclusive Patented Filtering Process that has made Luber-finer The Standard of The Industry Since 1936!!

THERE'S A LUBER-FINER MODEL FOR EVERY TYPE OF ENGINE— EVERY TYPE OF OIL!!

LUBER-FINER PACKS AVAILABLE

1. REFINING PACK
Introduced to the public in 1935 for use with straight mineral oils, fuel oils, hydraulic oils, and inhibited industrial oils.

2. DIESELPAK
First made available in 1941, the DIESELPAK was primarily designed for use with H.D. detergent compounded oils and has also achieved outstanding results when used with fuel oils and straight mineral oils.

DON'T BE MISLED BY PRICE ALONE!

There is no substitute for DIESELPAK'S Patented Filtering Process for H.D. Compounded oils AT ANY PRICE!
The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than ANY of the substitute filtering elements being offered for Luber-finer units.

IT PAYS TO GET THE BEST!

STANDARD OF THE INDUSTRY SINCE 1936

Luber-finer Units are Standard and Optional Equipment on America's Leading Diesel Trucks, Tractors, Stationary Engines.

Write for Complete Information to Dept. 51

LUBER-FINER, INC.
2514 S. Grand Ave., Los Angeles 7

new products

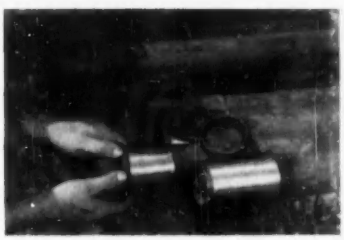
Pipe Corrosion Prevention

Here's an economical way to guard pipe and tubing against internal corrosion during storage. Roll-over and slip-on caps made of neoprene (Du Pont) seal out air, moisture, corrosive fumes, dust—and small animals.

By adding a small amount of dehydrating agent before slipping on the caps, the tube interior is protected from corrosion. It is also used to protect threads.

Two types are available: a roll-on cap for pipe two to ten inch diameter, and a heavier slip-on cap for two to twenty inch diameter. Either size is resistant to oils, acid and weather, and will take rough handling and reuse.

Many applications can be seen within the diesel industry.



Midget Pliers

Proto has introduced six matched midget pliers to its line. Forged of fine special steel, they are designed especially for fine electrical-type work.

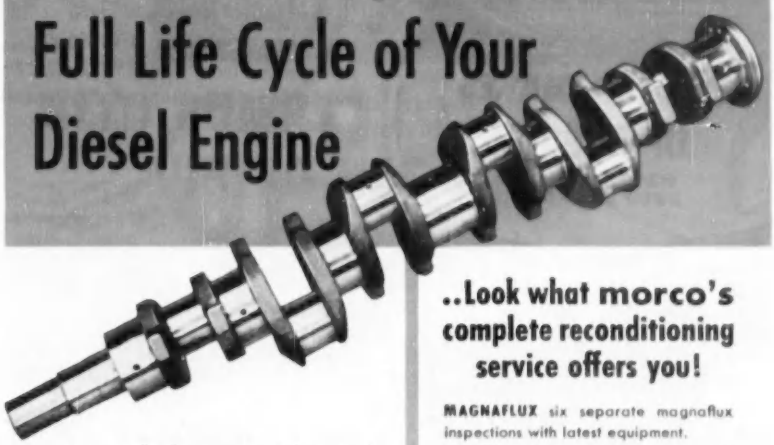
Heavy-Duty Cylindrical Grinder

A new line of heavy-duty cylindrical grinders has been announced by the Norton Company. These grinding machines are designed to handle workpieces weighing up to 6500-lb on centers.

A graduated hand-wheel continually indicates the amount of infeed as the wheel rotates past a fixed pointer. The indexing mechanism permits setting in increments of 0.0001 work diameter reduction without visual attention.

Grinders are available in either plain or semi-automatic models.

morco Factory-Certified Exchange Crankshafts give Trouble-Free Operation for the Full Life Cycle of Your Diesel Engine



morco dealers—coast to coast—are stocked with reconditioned, like-new crankshafts for different diesel engine models. Users of Detroit Diesel and Cummins engines can exchange worn shafts for MORCO factory-reconditioned shafts through authorized dealers.

Why take chances? Let your dealer be your source for dependable, safe crankshaft regrinding. You get immediate service, guaranteed quality and terrific economy. Ask your dealer about MORCO today.

..Look what morco's complete reconditioning service offers you!

MAGNAFLUX six separate magnaflux inspections with latest equipment.

GROUND on production type equipment to engine manufacturers' specifications. Original stroke retained.

TOCCO* HARDENED by the original equipment method when necessary.

ROLLED FILLETS increase strength at the most critical areas.

DYNAMIC BALANCE restored on original factory balancing equipment.

THRUST COLLARS and surfaces restored.

GEAR FITS renewed.

KEY WAYS restored.

DOWEL HOLES repaired.

OIL SEAL surfaces renewed.

THREADS repaired.

*TOCCO is a registered trademark of the Ohio Crankshaft Co.

morco INC.
BEDFORD, OHIO

a subsidiary of
The Ohio Crankshaft Company

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Please send free copy of "The MORCO Story":

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KATO

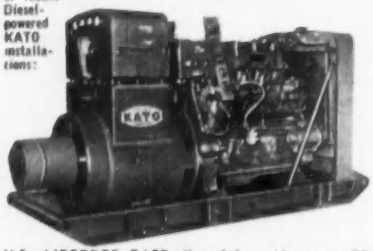
CONTINUOUS A.C. AND STANDBY

GENERATORS

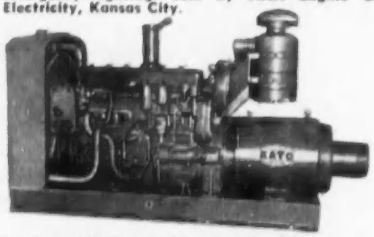
ARE ADAPTABLE TO ALL MAKES OF ENGINES...

SIZES TO FIT ANY NEED UP TO 500 KVA

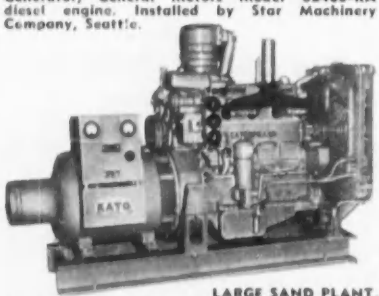
Three illustrations of recent Diesel-powered KATO installations:



U.S. AIRFORCE BASE, Grandview, Mo. uses 75-KW, 93.8 KVA, 120/240V., 60 cycle, single phase, 1800 RPM KATO Generator, driven by P & H Harnischfeger Model 487-18 diesel engine, for emergency lighting. Sold by AAA Engine & Electricity, Kansas City.



BOEING AIRPLANE CO., Seattle, Wash., purchased 175 KW, 219 KVA, 3 phase, 3 wire, 60 cycle, 1800 RPM, revolving field type KATO Generator, General Motors Model 62403-RA diesel engine. Installed by Star Machinery Company, Seattle.



LARGE SAND PLANT, operated by Barton Const. Co., uses Model 8SEP54, 150 KW, 187 KVA, 220/440V., 3 phase, 60 cycle, 1800 RPM, 2 bearing, close coupled type KATO Generator adapted to No. 0 bell-housing on Caterpillar D337 diesel engine. Sold by Wm. H. Ziegler Co., Minneapolis.

WRITE

Builders of Fine Electrical Machinery Since 1928

KATO Engineering Company

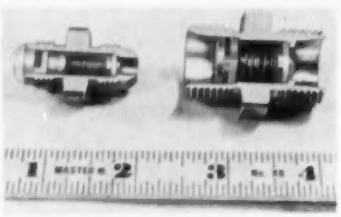
1408 First Avenue, Mankato, Minnesota

new products

Lightweight Check-Valve

Micro check valves manufactured by Integral Corp are designed to save weight and space. They conform to MIL-V-5524A specs.

Size range is from —4 to —32; pressure range from 0 to 5000-psi; heat range from —65°F to 275°F; available in aluminum, stainless steel and titanium.

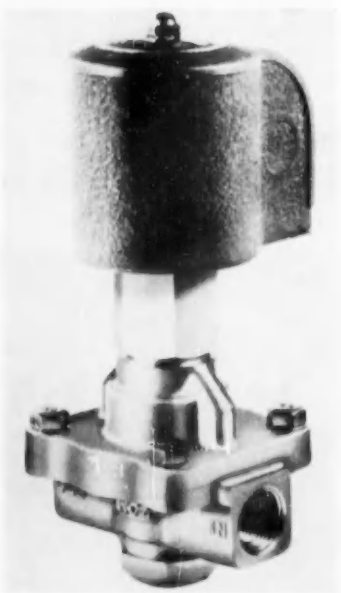


Heavy Fuel Solenoid Valve

A new high-pressure, heavy fuel oil, pilot-operated solenoid valve has been introduced by Automatic Switch Co.

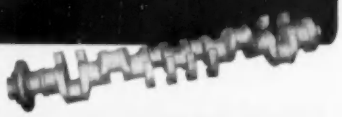
This packless, two-way bronze body valve has a ¾-in port and a pressure range of 15 to 300-psi. It handles heavy fuels up to 200°F.

It is used to automatically control the flow of heavy fuels in large industrial-type applications.



Park DIE-FORGED

CRANKSHAFTS



CRANKCASE PARTS

CONNECTING RODS

Are the Strongest "Links" in your Power Transmission Chain

For over 49 years, Park has specialized in the closed-die forging of crankshafts, connecting rods, camshafts, crankcase parts, main bearings, gears, pinions, axles and steering knuckles.

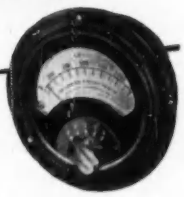
Park's facilities include a complete die sinking shop, modern specialized heat treating equipment and experienced metallurgical and engineering staffs.

Die Forging Specialists Since 1907

THE PARK DROP FORGE CO.
CLEVELAND 3, OHIO

CARBON, ALLOY AND STAINLESS STEEL CLOSED-DIE FORGINGS FROM 4 LB. TO 5000 LBS.

ADVANCE WARNING ...against engine damage



How much of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?*

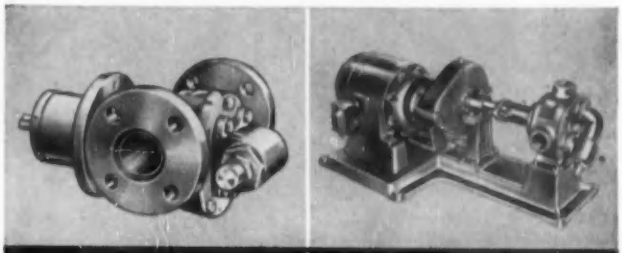
At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload **Preignition**
Scaled Jackets **Clogged Ports**
Detonation **Faulty Injection**

Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

Get Full information—*Quickly!* Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.

ILLINOIS TESTING LABORATORIES, INC.
Room 307, 420 N. La Salle St., Chicago 10, Illinois



NEED PUMPS to fit your machine or individual pumping units?
VIKING HAS THEM

Here's how to make sure you have the right pump for each job. Let Viking engineers help you choose. With 750 catalogued models PLUS thousands of special models available, Viking can fit your need. Capacities range from 2/3 to 1050 gallons per minute. Whether you want to pump a light, highly-volatile liquid or a heavy, semi-solid type, Vikings will give you smooth, positive action. For more information, write for catalog 56Sd today.

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "***ROTO-KING***" pumps
See our catalog in Sweets

HERE, FREE, IS AN AMAZING, SIMPLE BOOKLET YOU SHOULD HAVE . . . . .

10 POWER PACKED PAGES OF LUBRICATION FUNDAMENTALS

Covers centrifuging, oil reclamation, all types of filters and strainers, proper oil function, durability of lubricants, oil acids, abrasives, soot, in fact it offers a refreshing review of what good lubrication should be . . . . and how to get it.

MAIL THE COUPON — NO COST — NO OBLIGATION

Briggs
POWERED BY DESIGN FOR FILTRATION

OIL FILTERS

THE BRIGGS FILTRATION COMPANY
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YES! Send me your 10 page booklet

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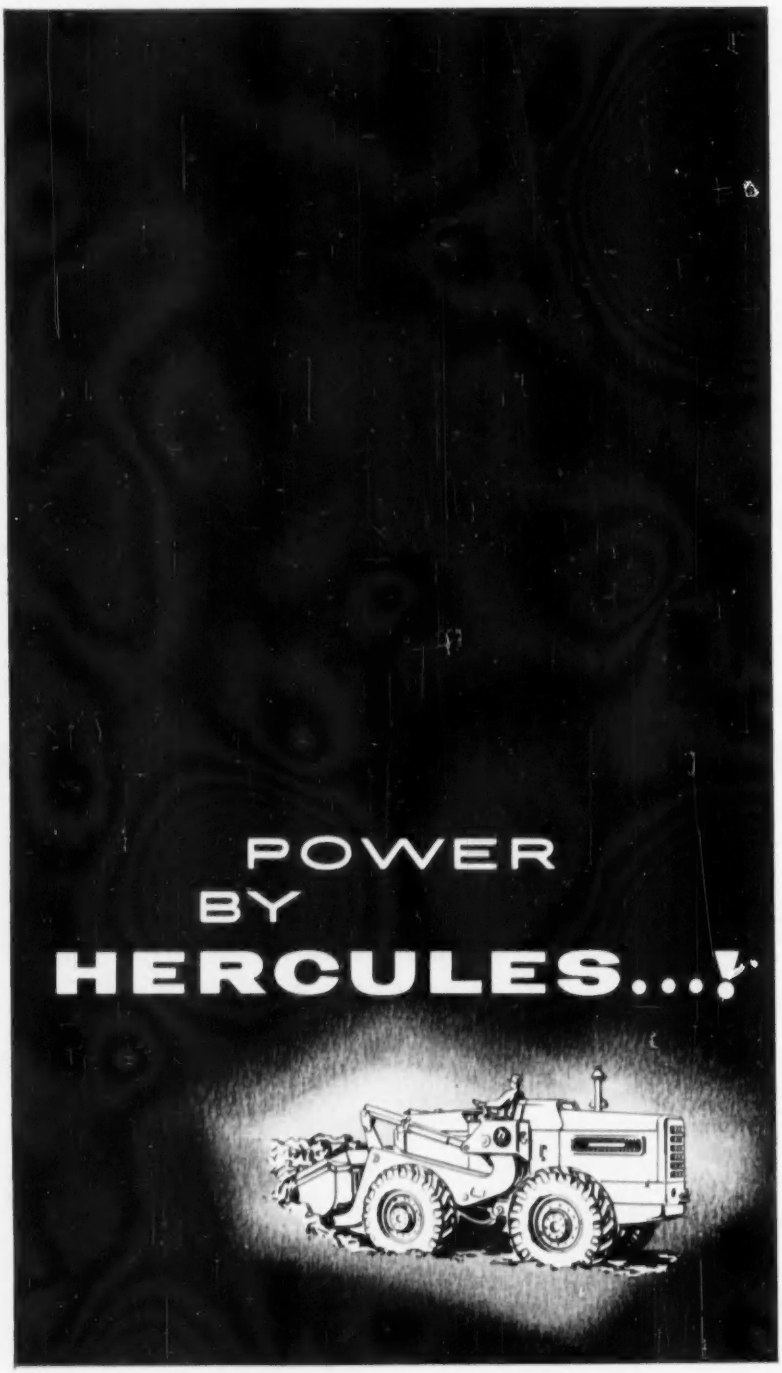
Company
Address



"PAYLOADER" Tractor Shovels rely on . . . power by Hercules. These popular tractor-shovels require lightweight, high-speed, heavy-duty engines. That's why Hercules Gasoline and Diesel Engines were selected for many of the "PAYLOADER" models.

Hercules on-the-job engines are tailored to the specific power needs of all types of equipment in the following industries: transportation, agriculture, construction, mining, industrial, logging, oil field and marine.

For "top-notch" performance, insist on . . . power by Hercules in your equipment.

HERCULES MOTORS CORP. • CANTON, OHIO

news of our industry

Mack Buys Beck

Mack Trucks, inc. has announced the acquisition of C. D. Beck & Co., a privately-owned manufacturer of inter-city buses.

Mack prexy P. O. Peterson called the purchase the first step toward the production by Mack of big, overland buses.

The Beck Co. will be operated as a division of Mack Truck. (Last month, Mack purchased Brockway Motor Co.).

Planned Purchasing

Canadian Pacific Railway Co., over the next 15-yrs, expects to make capital expenditures totaling $1.5 billion.

Of this, $125 million is earmarked for new diesel locomotives.

New Research Lab

National Carbon Co. (Div. of Union Carbide and Carbon) recently dedicated their new research laboratories at Parma, Ohio.

The lab will concern itself with chemical and physical research.

14-Day Non-Stop Running

Cathodic protection afforded to a pipe-line in Iraq called for a generator to operate continuously and unattended for 14-days.

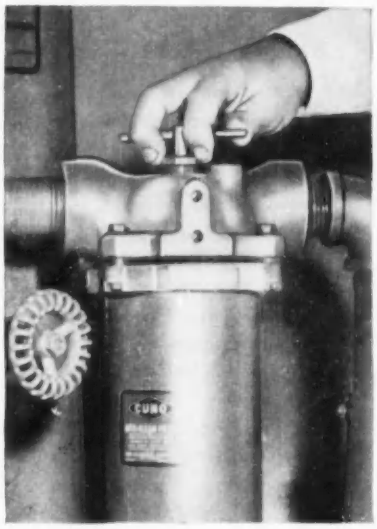
Ruston & Hornsby (British) adapted their standard 3XHRE diesel engine, by means of special lubrication and safety features, and set up a test.

Diesel engines are accustomed to this kind of operation. The engines are now working at their installations.

"Lorain" Dutch Subsidiary

Thew Shovel Co. has established a wholly-owned Dutch subsidiary for the manufacture and distribution of "Lorain" machines in Europe.

FILTRATION NEWS



Filter to 40 microns, turn handle to clean!

You can clean this 40-micron filter simply by turning the handle at intervals—or turn shaft continuously with motor drive.

It's Cuno's SUPER Auto-Klean—using a completely new principle in metal edge-type filtration.

For compact, economical engine fuel and lube, machine-tool coolant and cutting oils, and a wide variety of process fluids, SUPER Auto-Klean offers:

Complete protection against solid particles larger than 40 microns—actually 0.0015". Can't rupture or channel.

No cartridge changes—just turn handle frequently to clean and, at intervals, remove plug and drain sump.

Low pressure drop—3 psi drop with flow rate to 45 gpm for 8" long by 2¼" diameter cartridge and fluid of 200 SSU viscosity.

All metal construction—available in stainless steel for corrosion-resistance.

Standard housings—available with Cuno's standard AUTO-KLEAN housing; available also for integral sump mounting.

Write today for complete data on this outstanding Cuno filter development. Ask for Catalog SAK-057. The Cuno Engineering Corporation, 9-10 South Vine Street, Meriden, Conn.

63

CUNO ENGINEERED FILTRATION

AUTO-KLEAN (edge type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)

new products

Remote Reading Indicator

Robertshaw-Fulton Controls now makes a remote control device that measures the level in tanks over ¾-mi away.

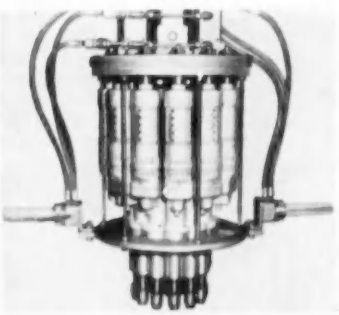
The instrument is called a capacity telemeter, and its accuracy is unaffected by weather conditions.

The meter is presently used where tanks are scattered over a large area; however it is feasible to use it for some single tank installations where a hard-to-measure situation exists.

Multiple Nutsetter

A twelve-unit multiple nutsetter designed to tighten simultaneously a dozen nuts to pre-determined torque.

Built by Thor Power Tool Co, this unit is engineered to tighten differential housing nuts for a major motor car manufacturer. Other units are being built to speed assembly in modern industrial plants throughout the country.



Lightweight Autocars

New light-weight models have just been announced by Autocar (White Motor Company). These new models are equipped in either axle-forward or axle-back models.

Weight saving is accomplished principally through the liberal use of aluminum. It is used in the cab, and in various parts of the engine. Many parts are of all-aluminum casting or weldment. Even the wheels are forged aluminum.

Built primarily for highway application, these Autocars have good power characteristics for heavy payloads.

Longer
Work Time
Keeps Your
Profits...UP
with

S-N
REDUCTION GEARS

POWER A DIESEL OR GASOLINE INDUSTRIAL ENGINE with S-N REDUCTION GEARS and Power Cut-Off Clutch

Regardless of the type of heavy duty equipment you are powering . . . there's a S-N Model and gear ratio to do the job — faster, and more economically. Seven models available. Remember S-N Reduction Gear Units insure smooth, full power from engine to load with maximum economy. Ideal for original equipment and all types of engines from 40 H. P. to 750 H. P. giants. Reduction ratios start at 1.5:1 and step-up to 4:1 in standard ratios. New catalog sheets are available.

SNOW-NABSTEDT
Transmission Engineers
FOR HALF A CENTURY
INDUSTRIAL DIVISION
THE SNOW-NABSTEDT GEAR CORP. HAMDEN CONN.

new literature

The HD-11 Crawler Tractor
powered by a 75-hp diesel, is the subject of Allis-Chalmers' newest catalog. Design, engineering, and operating data are highlighted by a series of assembly and parts photos.

Rectangular-Shaped Motors
are described in a two-color catalog sheet by Leece-Neville. A system is described wherein the manufacturer claims to take higher output from a small-size motor.

Nut & Bolt Catalog
published by Sterling Bolt Co., lists purchasing data on a large selection of metal fasteners. They also include standards, weights, design and other information of interest to the user.

Engineering Data Book
has been published by Lefax Publications.

It contains 350-pages of formulas and tables used by civil, mechanical and electrical engineers.

Heavy-Duty Separators
relative to the purification and clarification of diesel fuels are described in a 4-page bulletin by Centrico.

Government Procurement
called "Proprietary Manufacturing Know-How and National Defense Requirements" explains the ins and outs of government-industry relations. It is printed by the Machinery and Allied Products Institute.

Very helpful to contractors negotiating with the government.

Mexican Directory
compiled by the Confederation of the Chambers of Industry of the Republic of Mexico, is now available. It is called First National Industrial Directory of Mexico (third edition).

Another Torque Converter
the National Supply Company models, are explained in bulletin #468, covering horsepower ranges from 100 to 1000-hp.

Specs are given for 17 sizes and capacities.

Turbocharging Information
is available on a bi-monthly basis from the Brown Boveri Turbocharger News. Each issue will discuss some specific phase.

A letter or card puts you on the mailing list.

Quick starts down to

65 DEGREES BELOW ZERO

for Diesel and gasoline engines

SPRAY STARTING FLUID, with the propellent used in the pressurized can, insures quick starts for Diesel and gasoline engines in temperatures as low as 65° F. below zero and withstands 180° F. heat. This combustible propellent was developed after two years of research. SPRAY STARTING FLUID pressurized with our inert propellent is absolutely safe and odorless in storage.

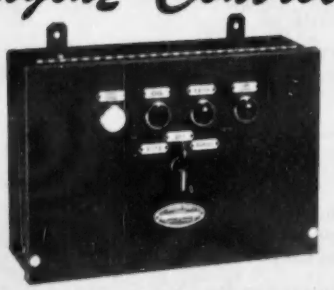
SPRAY STARTING FLUID is sold through distributors, wholesalers and their dealers located throughout the United States and Canada.

SPRAY PRODUCTS CORPORATION

P. O. BOX 584 • CAMDEN 1, NEW JERSEY

FULL AUTOMATIC

Engine Controls



Model 1436M4

SYNCHRO-START Engine Controls provide automatic start and stop from any type of remote pilot switch. Interrupted cranking periods with total time limit of cranking is a regular feature.

Standard Controls are available which provide FULL PROTECTION for the engine. The model shown will light an individual signal and operate an external alarm in event the engine fails to start. Should low oil pressure, high water temperature, and overspeeding occur while running, the engine will stop and Visual Signal will indicate source of trouble.

Additional safety features can be incorporated on special order.

These controls can be used with Diesel, Gasoline, and Gas engines.

Request Bulletin 501

Synchro-Start Products Inc.

8151 N. RIDGEWAY AVE. SKOKIE, ILL.

new literature

Wayne Pump Catalog
with the problems of the pump user in mind, has been published. The concept used in this catalog is said to be new to the industry, and is referred to as the "continuity" idea.

Consists of 20 pages in 3-color, and defines the internal-gear rotary pump line, now in five basic series. (See new products feature page).

Series-Parallel Switches
heavy-duty, in both 12-v and 24-v, are described in a catalog sheet just released by Leece-Neville.

Sixteen-Hundred American Standards
are indexed in the new list of American Standards just published. There are 400 in the electrical field alone.

The 56-page booklet also describes the work of the ASA, and list their special publications, many of which are free.

Also, Smole's Tables Handbooks
has been enlarged and revised.

First copies are off the presses, and will be of interest to civil and structural engineers, designers, draftsmen, architects and students.

Condensed Catalog on Clamps
hose locking tools, fittings, accessories, and how-to-order information has been released by Punch-Lok.

Also included, is info on the Clamp-Master kit for maintenance men.

Research Reports
numbering 205, conducted under the Air Force's materials research and development program are now published by the Dept. of Commerce.

The publication contains abstracts of research in adhesives, metallurgy, analysis and measurement, petroleum products, plastics, etc.

Automatic Bolt Tightening
permits accurate preloading to as high as 80% bolt yield-strength, as described in a 12-page catalog by Standard Pressed Steel Co.

Aluminum Oxide Data
including applications and machining practices, dimensions, and instructions are available from Metal Carbides Corp. Twelve-page catalog #D-56 treats of tool tips, disposable inserts, etc.

Super-Pressure Tubing
designed for safe service at pressures up to 100,000-psi is described in Data Memorandum #22, Superior Tube Co.

Coupling Selection Chart
developed by Morse Chain, is said to reduce the time necessary to select a flexible coupling to minutes. The chart, 22-in x 17-in, may be hung on a wall, inserted under a glass desk-top, or folded for filing.

The World's Leading Manufacturers of FUEL INJECTION EQUIPMENT *for* *Diesel Engines*

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Depots and Service Agents in over 100 Countries

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Head Office: 653 Tenth Avenue, New York 36, New York
Sales Office: 14820 Detroit Avenue, Cleveland 7, Ohio

AP 174-755

new literature

"New Life for Old Machines"
is the title of a booklet by Caterpillar.

The theme of this booklet is that the operator should periodically examine his operating costs in downtime and repairs. Perhaps his present machine is not as productive as it should be, or was in the past.

Several actual job installations are discussed.

"Alcoa Aluminum Handbook"
is claimed to be one of the most comprehensive aluminum reference handbooks ever to be compiled.

Following a theme of conciseness and convenience, the book presents data on aluminum alloys and mill products in an easy-to-read tabular form. There is little text.

Copies are available by writing on your company letterhead.

Towmotor Operator's Guide
has been put into a pocket-size edition. The manual covers subjects of interest to owners and operators of forktrucks, and is available on request.

Cradle-Mounted Centrifugal
Pumps class CRV, are described in a bulletin by Ingersoll-Rand.

Pumps described have capacities from 5 to 2800-gpm, and pressures from 10 to 525-ft total head. In addition, performance tables are shown.

Alco Products Review
Spring-Summer issue, is now off the press.

The 28-page product magazine contains articles on heat exchangers, diesel-electric drilling-rig power packages, Hi-Qua-Led leaded steel, Alcotwin fintube heat exchangers, and the new Alco model 251 diesel engine.

Thread Gall and Seizure
is the theme of the second Lubrication Newsletter of Alpha Molykote Corp. It includes information on the causes, as well as suggestions to remedy the problem.

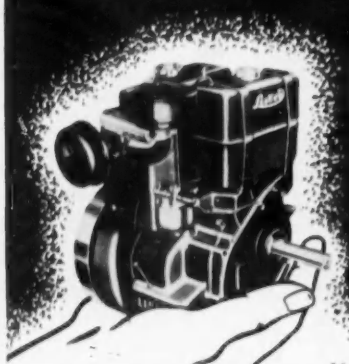
Compressor Trouble-Shooting
will be aided by a booklet that helps locate and correct common air-cooled and water-cooled compressor troubles.

The free booklet is with the compliments of Worthington Corporation.

Tests for Petroleum Products
in its third edition, outlines the significance of the various American Society for Testing Materials' methods of test related to petroleum products. It also mentions their limitations.

It has been prepared for petroleum executives, scientists, engineers, and others so concerned. The language has been kept relatively free of technical terms.

MORE POWER TO YOU



LISTER
AIR - COOLED
3½ H.P.
DIESEL
ENGINE

Versatile, adaptable, portable – immediate starts, and completely air-cooled, in any climate.

A full line of Lister-Blackstone Diesels from 3½ to 600 horsepower for marine use, generating, refrigeration, road construction, irrigation – wherever a diesel can be used, you'll get more power for less money with a LISTER.

Tell us your needs, we'll send details immediately.
AREAS OPEN FOR DISTRIBUTORSHIPS.

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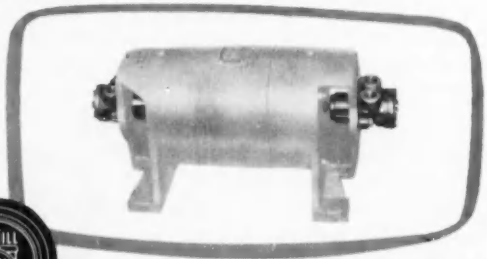
It's Just the PUMP You Want
...for FUEL TRANSFER and
HYDRAULIC GOVERNOR SERVICE

TUTHILL Model L

It holds its prime. It's mechanically sealed and leak-free. It's quiet in operation. It's low in power consumption. And it's built to give years of uninterrupted service. That's why the Tuthill Model L positive displacement, internal-gear rotary pump is preferred for fuel transfer and hydraulic governor service. Capacities from .33 to 6 g.p.m. in wide pressure ranges.

Write for Catalog No. 101 for complete details.



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Dependable Rotary Pumps . . . since 1927
939 East 95th Street, Chicago 19, Ill.

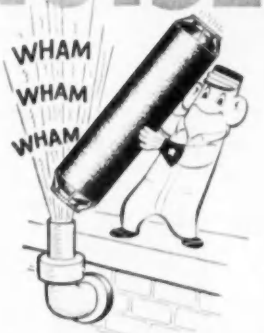
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

STOP THAT NOISE!

from Air, Steam and other gas discharges

with

BURGESS-MANNING SNUBBERS



From a WHAM

Stop that noise and profit through better neighbor and employee relations. Avoid compensation claims.

Burgess-Manning Snubbers are engineered to effectively correct your specific noise problem. *Tell us your noise problem and let us recommend—no obligation.*

BURGESS-MANNING COMPANY

Sound Engineering 751 East Park Avenue, Libertyville, Illinois

Dallas, Texas

KIENE® DIESEL

PRESSURE INDICATOR

gives compression and firing pressures faster

SIMPLE
RELIABLE
COMPACT

Send for Bulletin K-100

The Model K-100 Kiene Pressure Indicator accurately measures compression and firing pressures — assures the proper maintenance of diesel engines — helps prevent costly down time. Only one moving part — no friction or inertia effects — no complicated adjustments.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

Service Manager

appointment of Robert O'Connell has been announced by Gar Wood Industries' Findlay Division. Mr. O'Connell was formerly with Clark Equipment as Asst-Service Mgr., Industrial Truck Div.

R. O'Connell

W. C. Faust

Appointment

of William C. Faust to manager of public relations has been announced by the Electric Storage Battery Co. He formerly was public relations director for Geare-Barston, ad and public relations agency.

Works Manager

appointment of Eugene K. Kelly has been announced by Detroit Diesel Engine Div. of GM. Mr. Kelly succeeds Mr. Truxell, recently appointed general manager.

Prior to his appointment, Mr. Kelly was with aircraft at GM's Allison Division.

E. K. Kelly

R. W. Hermanson

Appointment

of Ray W. Hermanson as sales manager of the Wright Tool & Forge Co. was announced by C. Nelson Wright, pres.

Mr. Hermanson was formerly with Brea Chemicals. As sales manager, he will be in charge of all sales for the firm nationally and in Canada, and in addition will supervise advertising.

organizational news

Expanded Representation
has been announced by Applied Research Laboratories, with three South American appointments.

Expansion will include representation in Argentina, Brazil and Chile.

J. M. Canaris

Sales-Engineering Staff Appointment
of James M. Canaris has been announced by Briggs Filtration Co.

Mr. Canaris was formerly with the Lofstrand Co. Prior to this, he was with Briggs.

200 Farm-Equipment Dealers
in the Middle Atlantic and New England States are being added to the Minneapolis-Moline dealer organization and will be organized into a division of the firm.

M-M will assume the farm machinery franchise held by Frick Company.

E. D. Newell

Midwest Representative
has been appointed by Maxim Silencer Company. Edward D. Newell, an experienced mechanical engineer, was formerly asst-mgr of Application Engineering for Cooper-Bessemer in Mt. Vernon, Ohio.

Mr. Newell replaces E. E. Huff, who recently resigned.

Retirement
of Charles A. Winslow, founder and president of the firm, has been announced by Winslow Engineering Co. Mr. Winslow will retain a seat on the board of directors, and continue as engineering consultant.

New president is Lawrence L. Moore, former executive vice-president.

Also retiring with her husband is Mrs. Catherine B. Winslow, who has been secretary-treasurer of the firm for many years.

C. H. Winslow

Distributorship
has been given to McBeth Co. (Cincinnati and Philadelphia) for the Axelson line of heavy-duty line of engine lathes.

CARBURETOR CLEANER
COLD IMMERSION
CARBON DIGESTIVE SOLVENT
Extra heavy duty engine parts, jet turbine, diesel engine and 4 barrel carburetor cleaner

SELF-EMULSIFYING SCOURING SOLVENT
even eliminates the "elbow grease"
KIT U.S. PAT. 2,318,842

IMMEDIATE DELIVERY
1 PINT OR A TANK CAR
CURRAN CORP.
Mfg. Chemists
LAWRENCE, MASS.
GUNK CHICAGO CO. • CHICAGO, 38

ROCHESTER
can give you the right thermometer for the job . . .

BIMETAL THERMOMETERS are available in both angle-form and straight-form types. With straight-form models, stem may be located in any position around entire circumference of head.

ALL RMC thermometers are available with various stem lengths from 2½"—up to 70" on some models. All are hermetically sealed, silicone dampened, and have external recalibration feature.

MANY different types are available, with dial sizes ranging from 1" to 5". Scale Ranges from —150° F. to +1000° F. All RMC bimetallic thermometers are guaranteed accurate to 1% of scale range.

REMOTE INDICATING *Vapor pressure temperature gauges are available in production quantities—3½" dial—wide temperature ranges and tube lengths available.*

RMC
"You Can Rely On Rochester"
ROCHESTER MANUFACTURING CO.
41 ROCKWOOD STREET — ROCHESTER 10, N. Y.

AMOT SAFETY CONTROL

AMOT Model 1476-47 automatically shuts down engine on high water temperature or low lube oil pressure. Features are:

1. **No capillary tube and bulb used.**
2. **Uses well known AMOT element.**
3. **Several temperature sensing units can be used with one control unit.**
4. **Will operate an air whistle.**
5. **Will operate a diaphragm gas valve for large gas engine shut down.**
6. **Will operate as a diesel fuel shut off valve.**
7. **Available with 2" direct connected gas valve.**

AMOT CONTROLS CORPORATION

RICHMOND 1, CALIFORNIA

"TORQUE WRENCH" MANUAL

Sent upon request

Formulas
Applications
Engineering data
Screw torque data
Adapter problems
General principles

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

organizational news

Chairmanship
of the board has been given to Roger Tewksbury by the Oster Mfg. Co.

Also, T. S. Bonnema has been named president and general manager.

Five New Appointments
have been announced by the Byron Jackson Pumps inc.

R. A. Winsryg to regional manager of the Los Angeles region; formerly manager of the Houson region.

E. L. Lindsey to regional manager of the Houston region; formerly Los Angeles regional manager.

D. De Graffenreid to Asst regional manager at Houston; formerly asst to Robert Harcus, executive VP.

Jack Stewart from Houston to San Francisco as asst regional mgr, assisting Don Metz.

Randy Oran, sales engineer, from NY to Houston region as District Mgr.

Belgian Subsidiary
has been announced by Gardner-Denver to handle distribution. The corporation is called Gardner-Denver (Belgium) and will headquarter in Brussels.

New P.I.E. Terminal
is located in Kansas City. The Branch manager is George Leach.

Also P.I.E. recently acquired Orange Transportation Co. and Collett Tank Lines of Salt Lake City.

Engineer-in Charge
appointments have been announced by Allis-Chalmers steam turbine department.

Appointments include those of Ellis P. Hansen, mechanical design; A. C. Holmes, steam design; J. K. Dixon, development section; and F. E. White, marine and navy turbine sales.

Educational Appointment
of Dr. J. W. Bennett Jr. (U. of Tenn.) to the Educators Advisory Committee of the ATA National Committee on Education has been announced.

Dr. Bennett was recently appointed head of the Dept. of Transportation and Public Utilities, succeeding the late professor W. W. Way Jr.

The Educators Advisory Committee is a group of twelve educators who help guide the trucking industry's educational policies.

In Memorium

John Thomas, former vice-president (engineering) of ALCO Products, inc. died suddenly of a heart attack in Miami.

Following an illness in 1952, Mr. Thomas was appointed an engineering consultant, a post he held until his retirement, effective March 1 last.

organizational news

H. O. Penn Appoints
three new VP's and an Assistant Treasurer. The Cat distributor appointed:

G. Berger to Vice-President, Conn. Div.; A. V. La Penna to VP, Operations; and R. E. Reed to VP, Sales.

J. Mancuso, former Credit Manager, became Assistant Treasurer-Credit Manager.

Harrison Appointment
of J. Robert Jackson as Service Manager of the Harrison Radiator Div. of GM was announced.

Nordberg Distributor
for Louisiana, Mississippi, and Alabama is the Rogers Diesel Engineering Co. of New Orleans. They will handle Power Chief diesel and gas-engines, along with other Nordberg products.

Allison's Petroleum Industry Sales Office
has moved from Tulsa to Dallas. The move is designed to better serve customers in that part of the country.

Amer. Air Filter Announces
three executive changes.

R. W. Nelson, vice-president, is director of a new administrative Central Staff; J. Hellstrom, VP and Director of Sales will acquire the administration of the American Air Division; and J. W. May has been appointed Director of Technical Training.

NICAD Appointments
include T. Ulrich to Midwestern Manager of the Sintered Plate Battery Div. in Easthampton, Mass; and W. R. Albrecht to replace him as Midwestern District Manager in Chicago.

Also, M. E. Ingalls has been appointed Eastern U. S. District Manager of Sales by Nickel Cadmium Battery Corp. in Massachusetts.

New De Laval Branch Office
announced by the De Laval Steam Turbine Co. is to be located in Moline, Ill.

H. A. Besocke is the manager.

Diamond Chain Elections
resulted in the following appointments:

C. P. Kottlowski, to President and General Manager; Guy A. Wainwright, to Chairman of the Board; H. N. Cottingham, to Vice-President and Assistant General Manager; and G. E. Schloot, to Vice-President and Director of Personnel.

Leece-Neville Sales Representative
for the southeast territory is J. M. Young. He will work with franchised dealers from Florida, N. Carolina, S. Carolina, Georgia, Tennessee, Alabama and Miss.

J. C. Webber has also been appointed a District Manager, working in New York, Pennsylvania, and parts of Canada.

there are
Kittell
silencers for almost every purpose

Kittell Muffler and Engineering
915 South Santa Fe Avenue, Los Angeles, California

REBORE CONNECTING RODS IN YOUR OWN SHOP

New GREENLEE

HYDRO-BORER
Assures precise alignment.
Accurate to .0003" T.I.R.
Fast precision boring.

Quick, easy setups.
For any size rods.
A money-maker in every engine shop.

WRITE FOR COMPLETE INFORMATION

GREENLEE
GREENLEE BROS. & CO.
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FREE FORM FOR Further FACTS

If you would like further information on subjects advertised, new products described or new literature offered

or

if you would like to have us locate information on products or services not currently appearing in

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you have only to indicate your requests on these postage free post cards

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Please rush me further information on the following products

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described on pages _____, _____, _____, _____

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COMPANY _____ POSITION _____

ADDRESS _____

☐ please have a salesman call

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DIESEL PUBLICATIONS, INC.

80 LINCOLN AVENUE

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Postage Will be Paid by Addressee

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TITLE

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Stamford, Conn.

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—read it at your leisure . . . but indicate your title and company as we need this information for our files even if copies are sent home.

Are You Reading YOUR OWN PERSONAL COPY of Diesel Power?

• • • • or is this a pass-along copy . . . with pages clipped out . . . months late . . . . dog-eared?

DON'T MISS OUT on new developments — new techniques — new ideas for getting greater efficiency, cutting your costs . . . in every issue of DIESEL POWER.

GET YOUR OWN COPY EVERY MONTH—have it sent home where you can read it at your leisure . . . it costs so little—JUST 1¼¢ A DAY!

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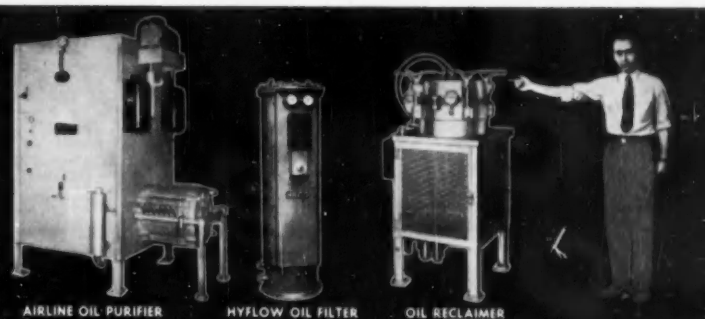

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organizational news

Zollner Changes
its name from Zollner Machine Works, inc. to Zollner Corporation.

B-L-H Consolidation Program
at the Eddystone Division has led to the appointment of E. F. Sheehan to Sales Manager for all transportation products.

Enterprise Shifts
former service-engineer C. H. Moeller to their contract engineering group at the San Francisco headquarters of Enterprise Engine and Machinery Co.

Also, M. T. Prendergast has been appointed Export Manager; and J. E. Wilson succeeded him as Manager of Service Parts.

Allis-Chalmers Appointed
W. J. Klein to Vice-President and Director of Sales; and W. L. Voegeli to General Sales Manager, Tractor Group.

Caterpillar Acquisition
of Englehart Mfg. Co. in Iowa was announced by H. S. Eberhard (pres.-Cat) and C. E. Murray (Pres.-Englehart).

The company will be operated as a wholly-owned subsidiary of Caterpillar.

F-M Recent Changes
V. H. Peterson, to VP in charge of engineering.

J. G. Graham, to General Manager of Railroad Sales in Chicago.

G. Anderson, Jr., Assistant Chief Engineer.

W. B. Morse, to Assistant to the Coordinator (Government Business).

Socony's Manager
of the company's research laboratories is Dr. Dayton H. Clewell. Dallas R. Lamont, who formerly acted as manager, made the announcement.

Garrett Appoints
Dr. W. T. von der Nuell to Assistant Chief Engineer, Turbomachinery Planning, for the entire corporation.

It was Dr. Nuell who designed and developed AiResearch's line of commercial turbochargers for diesel engines.

White Motor Company Announces
the appointment of L. A. Gosden as Gulf Coast representative of White Diesel Engine Division of the White Motor Company.

Also, A. F. Osseck was appointed Assistant Purchasing Agent.

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What Do You Know!

(Answers to Questions on Page 67)

1. Correct answer is "b". According to the American Road Builder's Association, about 40,000 miles of highways are to be built over a period of 13 years at an estimated cost of $27-billion. See Page 42.

2. Correct answer is "b". Trucking fleets, power plants, etc., rebuild engines according to miles or hours of operation. Construction equipment engines are rebuilt only when they can be spared or break down. See article on Page 46.

3. Correct answer is "b". Usually, lube oil and filters are changed on all tracters after the same hours of operation. The same goes for trucks, all scrapers, etc. See Page 46.

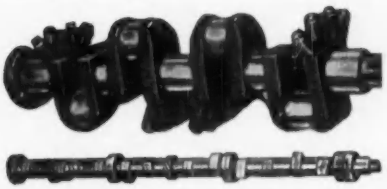
4. Correct answer is "b". A field shop is usually equipped to rebuild engines by replacing parts. Little of the actual rebuilding of parts is done. See Page 46.

5. Correct answer is "c". Since construction equipment usually can't be spared, engines are only rebuilt if they don't operate properly as indicated by excessive lube oil consumption, blowby, and consistent low oil pressure—or a major breakdown. See Page 46.

6. Correct answer is "c". Precision fitting of piston pins as well as con rod alignment are most accurately done by a boring machine which eliminates as much human error as possible. See Page 54.

7. Correct answer is "b". Variations in water pump size, flow rate, coolant volume, temperature differential, radiator resistance and average horsepower output usually call for a new radiator. See Page 56.

8. Correct answer is "a". By mixing various abrasives with water, a semi-automatic machine can wet-blast engine parts without disturbing precision tolerances. See Page 64.



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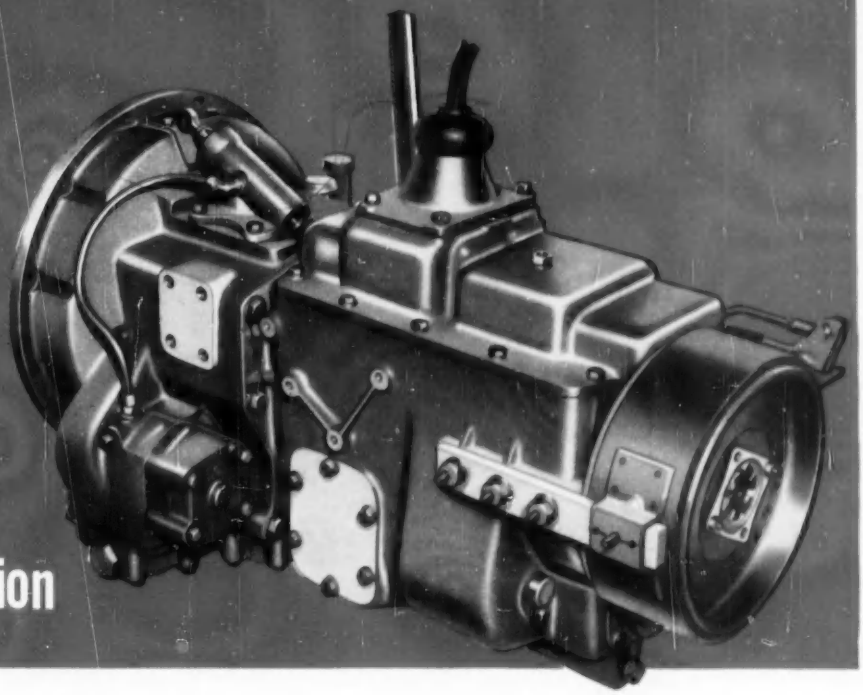

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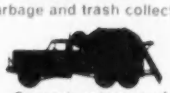

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(l. to r.) Carl Olbertz, Milford plant superintendent, "Rollie" C. Bleimehl, Standard Oil industrial lubrication specialist and Frank Morgan, Milford chief engineer inspect crankcase. Rollie Bleimehl is qualified to give technical service on jobs like this. He's been doing this sort of work for 10 years. Rollie has a mechanical engineering degree from Iowa State College and has completed the Standard Oil Sales Engineering School.

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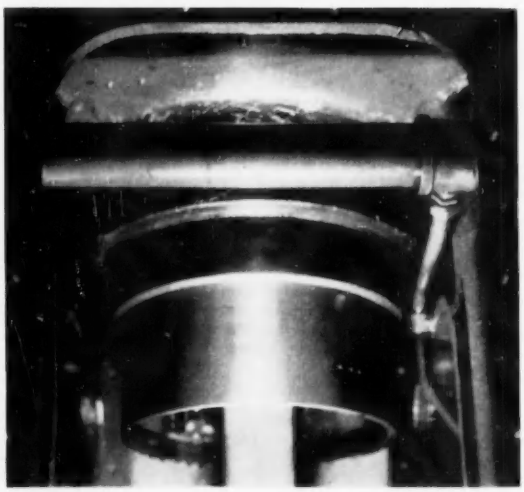

"As is" photo of piston skirt and interior of crankcase. No wiping or cleaning was done before photographing or at any time during 23,232 hours engine has been in service. STANODIESEL Oil M is the lubricant.

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